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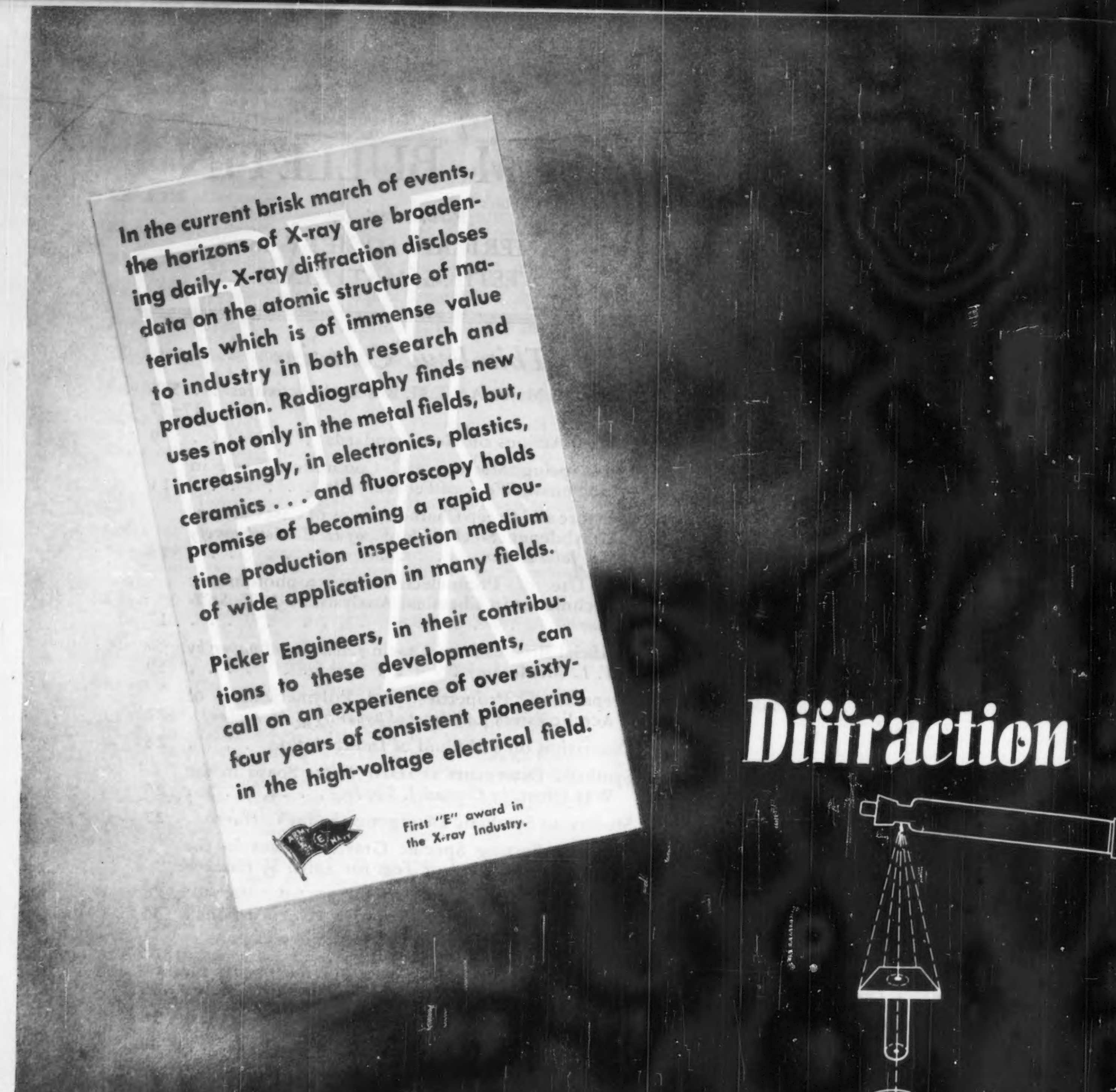
In the current brisk march of events, the horizons of X-ray are broadening daily. X-ray diffraction discloses data on the atomic structure of materials which is of immense value to industry in both research and production. Radiography finds new uses not only in the metal fields, but, increasingly, in electronics, plastics, ceramics . . . and fluoroscopy holds promise of becoming a rapid routine production inspection medium of wide application in many fields.
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ASTM BULLETIN

"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

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Review of Major A.S.T.M. Research Activities

More than 135 Projects Summarized

THE ACCOMPANYING material is intended to give a condensed review of major A.S.T.M. research activities either currently being carried on by the various technical groups responsible, or in some cases projects which may be practically completed but which have not been previously included in any review. Although there was an interim progress report in January, 1942, there has not been compiled since the October, 1940, BULLETIN a complete analysis of the research activities.

This review is the responsibility of A.S.T.M. Committee E-9 on Research which "is to consider means of promoting knowledge of materials, encouraging and stimulating investigations for this purpose, to bring about studies of properties on which information is needed, and to review annually the progress in A.S.T.M. research activities."

WHY A.S.T.M. RESEARCH?

Even before it was incorporated as a national society in 1902, the A.S.T.M. as a committee of the international association was concerned with promoting a better knowledge of the properties of materials; and consequently when it was obvious about 1900 that standardization would have to be one of the major aims of the American group, and the dual purposes of the new Society were stated, first was "promotion of knowledge of materials," and then came "the standardization of specifications and methods of tests." A major, perhaps *the* rock on which the validity and authority of A.S.T.M. specifications is based is sound knowledge of the properties of materials. Consequently, the research ties in very frequently with standardization activities, although a good many of the research activities, and numerous papers and publications are not immediately applicable for specifications or tests, yet the increased data on materials consistently result in better application, improvements, and generally increased efficiency.

VALUE OF A.S.T.M. RESEARCH

Obviously the answer to the question "What Is the Value of A.S.T.M. Research" is not a simple one. Perhaps the ultimate value is the greatly increased knowledge that individuals participating in and studying the research reports have acquired.

Certainly the very widespread use of A.S.T.M. standards directly reflects the Society's sound policy of research because, as has been frequently expressed, an A.S.T.M. standard is competent because it is based on *adequate scientific reseaerch*.

Certainly one of the aims in promoting knowledge of materials is to increase the efficiency and effectiveness of these materials, as expressed by Past-President F. M. Farmer. Numerous examples could be cited of the increased effectiveness of certain materials which have been modified as a result of A.S.T.M. research activities. The use of copper in limited amounts in copper-bearing steel is an example; the use of certain additives in treated portland cements is a very current achievement tying in with some of the A.S.T.M. activities. Methods of preparing steel for painting is still another and there are many, many more.

Dissemination of the data resulting from the research projects is essential and therefore very extensive publications have been issued which over the years represent a most amazing encyclopedia of data. These publications in themselves bespeak the value of A.S.T.M. research work, and justify the hundreds of thousands of dollars expended by industry and government in sponsoring the work, the tremendously large number of man hours expended, and the work of the A.S.T.M. Staff. A study of the accompanying material will convey some conception of the importance of the work.

All of these things suggest somewhat the value that has accrued from A.S.T.M.-sponsored research projects and another indication that the work is worth while is the readiness with which industry and various Government departments have wholeheartedly supported the work through the more than four decades of A.S.T.M. history.

KINDS OF RESEARCH

Just how to define research and how many of the projects are "pure" or "applied" research, and such related questions perhaps are primarily academic ones. It is interesting to realize that so many of the active projects are aiding in the solution of industrial problems. All kinds and shades of activity are represented in the upwards of 150 projects cited. One may be the collection and correlation

of existing data in certain fields and the subsequent publication of this; another may be the development of a precise method of testing involving perhaps some instrumentation problems, in which three or four laboratories of committee members cooperate in obtaining results, and then perhaps rerunning tests on a more precise basis as a check. These types and various shades of research projects stem to the very formal and extensive corrosion tests, for example, which are long-time propositions involving thousands of test specimens exposed at numerous test sites throughout the country with a large number of operators making annual inspections and listing results. Each project has its unquestioned value.

One pertinent point should be mentioned, the very close cooperation, evidenced in so many of the research programs through the large number of round-robin and cooperative test programs which form the basis of many of the activities.

EDITOR'S NOTE.—Concerning this research article, the material which follows has been reviewed generally by Committee E-9 on Research, primarily with the objective of insuring that the projects listed merit inclusion as being currently active. There are quite a number of additional projects which temporarily are held in abeyance either because of technical developments in the field or the effect of the war, or for other reasons.

In this material no attempt is made to give a complete history of a project, but rather some results of the work are cited, publications in which more detailed information can be found are noted, and where new work is to be undertaken, this is frequently mentioned.

It is believed references to publications will be obvious—1940 *Proc.* means 1940 *Proceedings;* references to compilations of standards are those sponsored by the various committees. Where a report is noted, for example, the 1942 report, this is included, of course, completely in the 1942 *Proceedings*. Headquarters Staff will be glad to furnish on request more complete information on any of the projects where such information is available.

Ferrous Metals

Microstructure of Cast Iron (Committee A-3, Sub. VII).—Collaboration with the American Foundrymen's Association resulted in report and detailed bibliography on aspects of graphite in cast iron. Recommended practice for evaluating the microstructure of graphite in gray iron (A 247) issued in 1941. Includes two series of photomicrographs and drawings covering the complete range in size and type of graphite commonly found in gray irons. A description of a standard procedure to be used in evaluating the microstructure of graphite, and a suggested method for metallographic polishing of gray iron are also included. New type of globular graphite reported in iron by National Bureau of Standards, but study of samples does not indicate that a revision of A 247 is essential. Post-war problems may include study of methods for determining cell size in gray cast iron and study of nonmetallic inclusions, especially in "inoculated" irons, see 1943 Committee A-3 Report.

Usage of Gray Iron at Elevated Temperatures (Committee A-3, Sub. XXII).—This newly organized subcommittee is developing information on usages of gray iron under severe temperature conditions. In cooperation with the American Foundrymen's Association, support has been received from the War Metallurgy Committee which group has completed an interesting study of actual field usages. Preliminary report extensively discussed at meetings in Buffalo and Pittsburgh, March and June, 1943.

Corrosion of Iron and Steel

Atmospheric Corrosion Tests of Copper-Bearing and Non-copper-Bearing Uncoated Sheets (Committee A-5, Sub. III).—Exposure tests began in 1915 of bare (uncoated) copper and non-copper-bearing steel and iron sheets under atmospheric conditions at Pittsburgh, Pa. (Completed, 1923; 1923 *Proc.*), Fort Sheridan, Ill. (Completed, 1928; 1928 *Proc.*), and Annapolis, Md. Results show most rapid rusting in the industrial atmosphere and especially the increased resistance due to copper additions up to at least 0.15 per cent.

Annapolis tests still in progress. Record of failures to date of No. 22 gage sheets reported, see 1943 Committee A-5 report.

Atmospheric Corrosion Tests of Uncoated and Galvanized Corrugated Sheets (Committee A-5, Sub. VIII).—Studies begun in 1926 at five test locations (Altoona, Pa., Brunot Island (Pittsburgh), Pa., Sandy Hook, N. J., State College, Pa., Key West, Fla.) representing various atmospheric conditions, on corrugated sheets both uncoated and galvanized with various weights of zinc coatings. For report of failures of all galvanized sheets after 7-yr. exposure at Altoona, Pa., and of progress at other sites (1934 *Proc.*) Failure of all sheets after $8^1/_2$-yr. exposure at Brunot Island, Pittsburgh, Pa. (1935 *Proc.*). Brief report on correlation of results of Brunot Island tests on sheets, hardware, and structural shapes and electroplated coatings on steel (1936 *Proc.*). Initial failures at State College observed; behavior of coated sheets at five test locations described; comparison made of relative severity of five locations on coated and uncoated sheets (1938 *Proc.*). Current report records coating failures at Sandy Hook and State College; behavior of coatings at Key West described; ten uncoated sheets exposed at five test locations to show contribution of coatings to life of sheets; data on time elapsing between exposure and perforation reported. Loss of weight experiment at Sandy Hook involving seasonal variations, started April, 1939. For interesting details of this test and further data on specimens at State College and Key West, see 1942 A-5 Report.

Atmospheric Corrosion Tests on Wire and Wire Products (Committee A-5).—Extensive country-wide outdoor tests of wire, and wire products, including unfabricated wire, barbed wire, wire strand, farm-field fencing and chain-link fence started in 1936 at 11 test locations (Sandy Hook, N. J.; Bridgeport, Conn.; State College, Pa.; Lafayette, Ind.; Ames, Iowa; Manhattan, Kans.; Ithaca, N. Y.; Santa Cruz, Calif.; College Station, Texas; Davis, Calif.; Pittsburgh (Brunot Island), Pa.). Materials include uncoated wire and fencing (both copper-bearing and non-copper-bearing), zinc-coated wire and fencing, corrosion-resistant steel wire and fencing, and lead-coated wire and fencing. Test sites are representative of atmospheric conditions from coast to coast. For detailed report on installation of test materials, refer to 1937 *Proc.*, Part I. Report of results of 2-yr. exposure tests at all locations and detailed data of referee tests at National Bureau of Standards to provide complete information on original characteristics of the material on test, including photomicrographs, etc. (see 1939 *Proc.*). (NOTE.—A special publication, "Wire Test Report," issued in 1939 gives the data from 1937 to 1939 *Proc.* Extensive report gives results of tests after exposure for about four years.)

1943 Committee A-5 Report gives results of tests after 6-yr. exposure. More than 900 specimens at each location which include short lengths of wire and wire strand at all eleven locations, farm-field fence at nine sites, barbed wire and chain-link at eight test sites. Includes extensive tabular data and discussion.

Weight, Uniformity, and Thickness of Galvanized and Electrodeposited Coatings (Committee A-5, Sub. VII).—Previous extensive studies involving tests for determining weight and

uniformity of zinc coatings on hardware and other shapes and methods for plated coatings including metallographic, stripping, dropping, spot tests, etc., resulted in various tentative standards. These cover the following: Uniformity of coatings by Preece test (copper sulfate dip) on zinc-coated (galvanized) iron or steel articles (A 239), and local thickness of electrodeposited coatings (A 219).

A special group issued report on the demand for and relative merits of methods for dropping test to determine thickness of zinc and cadmium coatings on steel. Some consideration given to magnetic test method for determining thickness of coatings (for interesting report, see ASTM BULLETIN, March, 1942).

A Field Conformance Test Subgroup is investigating the limitations of the various field testing methods previously reported on (such as dropping test methods and magnetic test methods) for determining the thickness of protective coatings.

Atmospheric Corrosion Tests of Metallic-Coated Hardware, Structural Shapes, Tubular Goods, etc. (Committee A-5, Sub. VIII).—Studies begun in 1928 at five test locations, representing various atmospheric conditions, on metal products coated with the following eight types of coatings by commercial operations: Hot-dipped zinc, electrodeposited zinc, sherardized (zinc) applied in gas-heated drum, sherardized (zinc) applied in electrically heated drum, electrodeposited cadmium, hot-dipped aluminum, hot-dipped lead (Amaloy), parkerized. Results reported of inspections of the specimens at all test locations after 2-, 4-, and 6-yr. exposures, respectively (1931, 1933, 1935 *Proc.*). Brief report on correlation of results of this project with other corrosion studies by the committee (1936 *Proc.*). Extensive data given showing rusting that has occurred on samples since 1935 report (1938 *Proc.*).

The committee hopes to submit a detailed report of the latest data for publication in 1944. Hardware racks at State College and Sandy Hook reconditioned with numerous specimens remounted—largely those with hot-dip zinc, aluminum or lead coatings and some sherardized coatings. 1943 A-5 Report shows the identification and positioning on the racks of the remounted samples as well as positions on the original racks.

Magnetic Properties

Magnetic Properties—Direct Current Test Methods (Committee A-6, Sub. III).—Earlier work, including round-robin tests, formed basis of standard methods of test for magnetic properties of iron and steel (A 34). 1941 Report indicates that a check by various cooperators on the accuracy of permeameters used with high coercive force materials gave remarkably close results. Another phase of this work involves tests for permeability of feebly magnetic materials (A 259), issued in 1942. Based on the technical paper by J. P. Barton and G. W. Smith, "A Measurement of A-C and D-C Permeability," 1943 *Proc.*, the committee will prepare a standard for this type of direct current testing. Further investigations may result in a combination of certain existing standards to apply to both alternating current and direct current tests.

Magnetic Properties—Alternating Current Tests (Committee A-6, Sub. IV).—Studies made some years ago involving use of materials in apparatus operating at high frequencies and low inductions and also involving interlamination resistance of iron and steel resulted in standards methods of tests for magnetic properties of iron and steel (A 34). Later work involves interlaboratory tests on 25-cm. Epstein specimens involving core loss and alternating current permeability with double lapped joints and core loss with butt joints. Ballistic tests also being made. The other series involves incremental permeability tests. In both series checks so far obtained have been fairly good (1941 *Proc.*).

Additional tests, one covering permeability and core loss of flat-rolled magnetic materials using 28-cm. specimen (A 257), the other for incremental permeability and core loss of flat-rolled magnetic materials at low inductions using 28-cm. specimen (A 258), issued after good agreement was evident among interlaboratory tests. Preliminary to agreeing on test procedures for measuring core loss at frequencies up to 10,000 cycles per second, round-robin tests on a small number of sheet samples are under way using a watt-meter method.

The committee hopes to obtain information on aging data of commercial electrical sheet at temperatures above 100 C. (1942 and 1943 Committee A-6 Reports).

Reprints

It is planned to strike off reprints of this research article comprising pages 5 to 8 and 47 to 57 inclusive. A copy will be furnished without charge to members and committees on request.

Stainless Steels

Methods of Corrosion Testing of Stainless Steels (Committee A-10, Sub. IV).—Early report (1933 *Proc.*) described results from laboratory tests and inspection tests. Further studies resulted in a tentative practice for conducting plant corrosion tests (A 224–41). Later development is a standard boiling nitric acid test (A 262–43 T). In the near future the committee hopes to agree on methods of immersion testing.

Atmospheric Exposure Tests of Stainless Steels (Committee A-10).—The committee in its 1943 report announces a program to establish durability data by visual examination and also by change in mechanical properties. One industrial and two marine atmospheric sites contemplated. May involve plain sections and sheets and also spot-welded stressed or cold-worked forms such as may be used in architectural or engineering structures or transportation equipment.

Metallographic Studies of Stainless Steels (Committee A-10, Sub. VI).—Investigation of the phenomenon of grain boundary precipitation in the 18 per cent chromium, 8 per cent nickel alloy steels with a view to determining the nature of the precipitate. Studies made on two heats of these steels in three conditions, quenched, medium, and badly precipitated as to carbide. Metallographic examination completed and data reported (1939 *Proc.*). 1942 Report gives additional information and discussion of experiments involving heating to temperatures of 550 to 850 C. and the use of certain etches. Also a use of the acidified copper sulfate solution test to determine intergranular corrosion. While tests have not determined nature of the material precipitated, they have established that there is no correlation between the amount of precipitated material observed in the grain boundaries by microexamination and the susceptibility to intergranular corrosion. There is some indication that when the intergranular precipitation is thin and continuous, intergranular corrosion susceptibility is high, and when the separated particles between the grains are large, distinct, and not continuous, the susceptibility is very low or absent.

Correlation and Classification of Data on Stainless Steels (Committee A-10, Sub. I).—Based on intensive work in collecting and classifying data, a valuable publication was issued by the Society in 1942 entitled "Tables of Data on Chemical Compositions, Physical and Mechanical Properties of Wrought Corrosion-Resisting and Heat-Resisting Chromium and Chromium-Nickel Steels." In cooperation with the Alloy Castings Institute, the committee plans to issue comparable data on high alloy chromium, and chromium-nickel steel castings which may include about 25 alloys.

Mechanical Tests of Stainless Steels (Committee A-10, Sub. V).—The round-robin test program conducted by five companies on seven different grades of stainless steel sheets produced data indicating the necessity of using in specifications the property of yield strength as determined by the offset method instead of the yield point formerly used. Certain A.S.T.M. specifications just modified as a result. Committee is continuing cooperative work to determine effect of variations in rate of strain in conducting tensile test and also to evaluate the effect of variations in preparation of samples.

Non-Ferrous Metals and Alloys

Requirements for Lead Alloy Coated Copper Wire for Electrical Purposes (Committee B-1, Sub. X).—Emergency specifications for lead-coated and lead-alloy coated copper wire for electrical purposes ES-1a issued in 1942 as a result of cooperative work in the committee. Since insufficient data were available covering tests for ductility of coatings, additional tests have been carried on but agreement not yet reached. Visual inspection of coatings after bending around a mandrel is one proposed procedure. (For pertinent technical paper see "Lead Alloy Coated Copper Wire for Electrical Conductors" by C. J. Snyder, 1943 *Proc.*)

Corrosion of Non-Ferrous Metals

Atmospheric Corrosion of Non-Ferrous Metals and Alloys (Committee B-3, Sub. VI).—Comprehensive field corrosion studies started in 1931 at nine test locations from coast to coast (Pittsburgh, Pa.; Altoona, Pa.; New York, N. Y.; Rochester, N. Y.; Sandy Hook, N. J.; Key West, Fla.; La Jolla, Calif.; State College, Pa.; Phoenix, Ariz.) representing various atmospheric conditions, on 24 non-ferrous metals and alloys in the form of rolled sheet or strip. (Commercial-copper, -aluminum, -nickel, -zinc, -tin; aluminum bronze; manganese bronze; brasses; Admiralty metal; chemical lead; etc.) Full details of materials and their properties given in 1932 *Proc.* Corrosion over 25-yr. period to be measured. For comprehensive data resulting from 1-, 3-, and 6-yr. exposures on changes in weight and tensile properties, also records of visual inspection and meteorological data, see *Proc.*, Vols. 33, 35, and 38. 1939 *Proc.* had two interesting technical papers—one by C. W. Borgmann on "Atmospheric Corrosion of Non-Ferrous Metals and Alloys," the other by Messrs. Anderson and Reinhard on "Chemical Removal of Corrosion Products in the Determination of the Corrosion Rate of Zinc." Results of ten-year tests published in 1943 Committee B-3 Report covering exposure periods, change in weight tests, tension tests, and statistical analysis of data, visual inspection, etc. Extensive tables summarize data. The committee plans to give discussion and conclusions of ten-year tests, in the 1944 Report, with possibly appended technical papers. Pertinent technical paper on "Atmospheric Corrosion of Copper" by Messrs. Tracy, Thompson and Freeman, in 1943 *Proc.*

Total and Alternate Immersion Tests of Non-Ferrous Metals (Committee B-3, Subs. I and II).—Data obtained by cooperating laboratories in total immersion tests on copper in normal solutions of sulfuric acid, sodium chloride, and sodium hydroxide, aerated and nonaerated, were analyzed statistically. After some further studies a new method of total immersion testing (B 185) was issued in 1943. Technical paper on "Total Immersion Tests" by W. A. Wesley published in 1943 *Proc.* In work on alternate immersion tests equipment used at different member laboratories was inspected. Proposed test is being recirculated among committee members in preparation for rewriting and publication.

Salt-Spray Test (Committee B-3, Sub. VIII).—Based on cooperative tests involving various methods of accelerating corrosion of non-ferrous metals, agreement was reached on standardized salt-spray test B 117, issued in 1939. Method approved in 1943 as emergency procedure for testing organic coatings on the recommendation of Committee D-1. Interesting paper by C. H. Sample, with discussion published in the BULLETIN, August, 1943, covering "Use and Misuse of the Salt Spray Test as Applied to Electrodeposited Metallic Finishes."

Galvanic and Electrolytic Corrosion (Committee B-3, Sub. VIII).—Atmospheric galvanic corrosion tests on types 304 and 316 stainless steels, coupled with various other metals, have been in progress at New York, N. Y.; Altoona, Pa.; State College, Pa.; and Wilmington, N. C., since 1941. The metals coupled with stainless steels include aluminum alloys, copper, steel, lead, zinc, monel metal, and architectural bronze. Since mild steel disks showed abnormally low copper, new couples with this material will be exposed and an additional material, type 430 stainless steel will be coupled with 24S-T aluminum alloy.

This work continues very extensive earlier work involving numerous couples exposed at nine test locations with final report in the 1939 *Proc.* Work also included studies of electrolytic action of couples of various metals in certain liquids. Two pertinent technical papers, one by F. La Que and G. L. Coxe entitled "Some Observations of the Potentials of Metals and Alloys in Sea Water," and the other "Controlling Factors in Galvanic Corrosion," by W. A. Wesley, published in the 1940 *Proc.*

Electrical Resistance Alloys

Resistor Alloys in Controlled Atmospheres (Committee B-4, Sub. IX).—This work was started in 1939 to investigate cooperatively some little-understood phenomena of deterioration of resistor alloys and related materials when exposed to special atmospheres such as those used in electric-furnace brazing and bright-annealing processes. Laboratory investigations were carried out by five leading companies, which exchanged data on field experiences.

It was found that sulfur was a potent source of trouble and that a very destructive localized type of attack designated as "nodular" occurred at temperatures near 1750 F. in atmosphere comprising H_2, CO_2 and CO such as those derived from the partial combustion of natural gas and similar fuels. In the absence of sulfur a more general type of deterioration aptly called "green rot" may occur in the temperature range between approximately 1600 and 1800 F. In this type of attack almost complete oxidation of the chromium in a Ni-Cr alloy may occur leaving an electrically conductive residual structure of nickel which may serve as a resistor until some mechanical incident precipitates failure. It has been found that the rate of movement of the test atmosphere with reference to the test specimen may be a controlling factor in producing deterioration.

The work of this committee has led to better understanding of a very prolific cause of trouble in controlled-atmosphere electric furnaces and has enabled producers of the alloys in question to take effective steps to improve their product and electric furnace manufacturers and users to avoid improper atmospheres and destructive operating conditions. Work continues in an effort to determine quantitatively the effect of sulfur and water-vapor at various temperatures and to study the effects of carburizing atmospheres.

Life Test for Durability of Electric-Resistance Wire (Committee B-4, Sub. I).—Previous research work resulted in the standard accelerated life test B 76 adopted as standard in 1939. Later tests were planned to cover the effect of ceramics and cements on the life of heating elements and materials but these are temporarily deferred. Inter-laboratory life tests have been made recently to check equipment and test procedures and showed good agreement in two cooperating laboratories. Further work to be done when feasible. The National Bureau of Standards has a life test board to make standard tests. As a service the Bureau carries in stock for sale some of the 80 per cent nickel, 20 per cent chromium wire for use as a comparison standard.

Studies of Wrought and Cast Alloys for High-Temperature Use (Committee B-4, Sub. V).—This work involves the development of tests and specifications for heating and resistance alloys used at elevated temperatures. Tests in which the group is interested involve thermal conductivity, thermal coefficient of linear expansion, warpage, etc. Test for linear expansion (B 95) issued in 1939. The committee submitted a detailed report covering percentage of nickel needed in heat-resisting alloys for basis of action by the War Production Board, March, 1942. It is continuing the study of properties and tests of alloys used at high temperatures.

For extensive material on other nonferrous materials, cementitious materials, paint, petroleum, coal, plastics, etc., please turn to page 47.

Current Actions on New and Revised Standards

New Standards Cover Ready-Mixed Concrete, Seamless Drum Forgings, Rubber Tests; Emergency Provisions Approved

AMONG VERY RECENT important actions approved by Committee E-10 on Standards on the recommendation of several technical committees are new specifications covering carbon steel seamless drum forgings for use in boilers and other pressure vessels (A 266 – 43 T); new requirements in the form of an extensively revised specification for ready-mixed concrete (C 94 – 43 T) on which subject there has been much discussion in recent months; and two new methods covering the testing of rubber compounds for resistance to accelerated light aging (D 750 – 43 T) and calibrating a light source used for accelerating the deterioration of rubber (D 749 – 43 T). Other specifications affected by changes cover arc-welding electrodes (A 233); expansion joint fillers for concrete (D 544 and D 545); tar (D 490); several steel plate specifications; and various tests for rubber products.

Certain emergency alternate provisions are published in the back portion of this BULLETIN.

Steel Drum Forgings:

For some time there have been discussions in Committee A-1 on Steel, notably in Subcommittee VI on Steel Forgings, concerning the lack of a specification for seamless drum forgings and the desirability of filling this gap in the series of standards developed by Committee A-1. Discussion in certain emergency steel projects, the decision of the Boiler Code Committee to incorporate the A.S.T.M. specification symbols in code references, and the desirability of an up-to-date specification led to the formation earlier this year of a special section headed by A. O. Schaefer, The Midvale Co., and including leading producers and consumers of drum forgings.

With one exception (Specification S 4, drum forgings) the A.S.M.E. Boiler Code steel requirements are based on the A.S.T.M. steel specifications and the development of this new specification (A 266) which will be referred to the Boiler Code Committee for consideration will provide an up-to-date version of S 4. Three grades of material are covered, two of which are suitable for fusion welding. Chemistry requirements are nominal, and tensile requirements 60,000, 70,000, and 75,000 psi., respectively, with varying ductility requirements ranging from 24 to 26 per cent elongation longitudinally, 19 to 23 transverse (all in 2-in. gage length).

During drafting of the specifications, there was considerable discussion with respect to aluminum-killing of steel because of questions which arose in certain high-temperature piping failures and the committee finally agreed to incorporate a grain-size limitation for vessels that will be subjected to temperatures above 800 F.

This specification will be incorporated in the 1943 Supplement, Part I, and separate copies will be available on purchase within the next few weeks. The specifications were approved on November 17.

Revised Specifications for Ready-Mixed Concrete:

The important revisions incorporated in the new Tentative Specifications for Ready-Mixed Concrete (C 94 – 43 T) which supersede the previous item, C 94 – 42 T, are based on very intensive discussion in Committee C-9 on Concrete and Concrete Aggregates. Actual work on the specifications was carried out by a subcommittee headed by R. B. Young, Hydro-Electric Power Commission of Ontario, including outstanding authorities in the field. The revisions were approved by Committee C-9, and by official action of the Society through Committee E-10 on October 25.

In these specifications ready-mixed concrete is defined as portland cement concrete manufactured for delivery to a purchaser in a plastic and unhardened state and delivered in a truck mixer or a truck agitator. The material is intended for general use; requirements for quality of materials and proportions in concrete are either as specified in the standard, or as specified by the purchaser by referring to other applicable general specifications for concrete. This setup places responsibility for quality either on the producer to furnish concrete of a required strength or in the other case, the responsibility is on the purchaser. For

Recent Actions by Committee E-10 on Standards

NEW AND REVISED TENTATIVE STANDARDS

Specifications for:

- Carbon-Steel Seamless Drum Forgings (A 266 – 43 T) (new).
- Iron and Steel Arc-Welding Electrodes (A 233 – 43 T).
- Ready-Mixed Concrete (C 94 – 43 T).
- Tar (D 490 – 43 T)

Methods of:

- Calibrating a Light Source Used for Accelerating the Deterioration of Rubber (D 749 – 43 T) (new).
- Testing Rubber Compounds for Resistance to Accelerated Light Aging (D 750 – 43 T) (new).
- Testing Asphalt Composition Battery Containers (D 639 – 43 T).
- Chemical Analysis of Rubber Products (D 297 – 43 T).
- Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids (D 471 – 43 T).
- Testing Compressed Asbestos Sheet Packing (D 733 – 43 T).

TENTATIVE REVISIONS OF STANDARDS

Specifications for:

- Preformed Expansion Joint Fillers for Concrete (Nonextruding and Resilient Types) (D 544 – 41).

Methods of:

- Testing Preformed Expansion Joint Fillers for Concrete (Nonextruding and Resilient Types) (D 545 – 41).

EMERGENCY ALTERNATE PROVISIONS

- Boiler and Firebox Steel for Locomotives (A 30 – 42).
- Carbon-Silicon Steel Plates of Ordinary Tensile Ranges for Fusion-Welded Boilers and Other Pressure Vessels (A 201 – 43).
- Chrome-Manganese-Silicon (CMS) Alloy-Steel Plates for Boilers and Other Pressure Vessels (A 202 – 39).
- Low-Carbon Nickel-Steel Plates for Boilers and Other Pressure Vessels (A 203 – 42).
- Molybdenum-Steel Plates for Boilers and Other Pressure Vessels (A 204 – 42).
- High Tensile Strength Carbon-Silicon Steel Plates for Boilers and Other Pressure Vessels (Plates 4½ in. and Under in Thickness) (A 212 – 39).

concrete of a specified strength, suggested minimum strengths are given for different types of exposure. A very important addition in the new specification is a provision which should lead to more careful attention to the efficiency of the mixing and agitating equipment, even though the committee did not feel able now to incorporate mandatory procedures for testing this equipment. To assure more uniform consistency from batch to batch at point of delivery, the maximum number of revolutions of a truck mixer at mixing speed is reduced from 150 to 100. Other modifications relate to basis of strength requirements involving number of tests, value of results, and related matters. Another very important change is the omission of mandatory requirements for tests of specimens cut from the structure, in the event of failure of acceptance tests to meet specifications, and the substitution of an arbitration clause.

Arc-Welding Electrodes:

The revisions in the Tentative Specifications for Iron and Steel Arc-Welding Electrodes (A 233) were developed by the Joint A.W.S.-A.S.T.M. Filler Metal Committee headed by J. H. Deppeler. The changes basically incorporate a requirement that in testing the electrodes in the E80-, E90-, and E100-classifications which have tensile strengths ranging from 80,000 to 100,000 psi., the assembly shall be allowed to cool in still air below 212 F. before immersing in boiling water for 5 min. The boiling-water immersion is not to quench the assembly but is intended as a preheat. Some of the code requirements specify that a weldment shall become "hand-cool" after depositing each layer and the reference to boiling water immersion is intended to be considerably more exact concerning temperature and also the time element.

Another change is the deletion of values for tensile properties of the E70-classifications specified for nonstress-relieved conditions (NSR).

Tar; Joint Fillers:

The tentative revisions approved for publication in specifications D 544 – 41 covering preformed expansion joint fillers for concrete, will eventually provide for the inclusion of a bituminous fiber filler which would consist of preformed strips formed from cane or other suitable fibers of a cellular nature, securely bound together and uniformly impregnated with a suitable bituminous binder. The thickness recovery requirement for this material after one hour of the third application is to be at least 70 per cent compared with 90 per cent for the other four types included in the standard. Corresponding changes in the Standard Methods of Testing Preformed Expansion Joint Fillers for Concrete (Nonextruding and Resilient Types) (D 545 – 41) provide requirements covering the proposed new type. These proposals will be published for a year or more for comment and criticism before incorporation in the standards.

The revisions which will be incorporated in the Tentative Specifications for Tar (D 490) provide for the inclusion of a reference to a method developed by the Association of State Highway Officials, AASHO Method T 108 covering sulfonated index of road tar. Meanwhile, similar tests will be given further consideration by the committee.

Emergency Marking of Small Steel Plates:

In the interest of increased production, Committee A-1 on Steel through its Subcommittee XI on Boiler Steel has approved a suggestion from manufacturers on an emergency change in the marking clause providing that small plates, no dimension greater than 48 in. regardless of shape of the plate, shall be marked only in one place with the specified markings. The present requirements in the specifications involved require the marking to be stamped or stenciled (depending on thickness) in two places. Pink slips with this change are in preparation. Specifications affected cover various types of carbon and alloy-steel plates applicable for use in locomotives, fusion-welded boilers, and other pressure vessels with the designations A 30, A 70, A 201, A 202, A 203, A 204, A 212.

New Standards and Emergency Actions on Rubber and Rubber-Like Materials:

In addition to the two new tentative methods of testing rubber compounds for resistance to accelerated light aging (D 750), and calibrating a light source (D 749) developed by Committee D-11 on Rubber Products, a revision has been accepted in the Emergency Specification covering rubber sheath compound for cords and cables (ES 6) and four tentative methods have also been revised covering the following:

- Testing Asphalt Composition Battery Containers (D 639 – 43 T),
- Chemical Analysis of Rubber Products (D 297 – 43 T),
- Test for Changes in Properties of Rubber and Rubber-Like Materials in Liquids (D 471 – 43 T), and
- Testing Compressed Asbestos Sheet Packing (D 733 – 43 T).

Both new methods were first published in August, 1940, to stimulate comment and criticism and changes were incorporated based on considerations of certain of the requirements. The test for light aging covers various types of equipment available commercially and is intended as an accelerated test applicable for estimating the comparative resistance of soft vulcanized rubber compounds to deterioration when exposed to light having a frequency range approximating that of sunlight, but a greater intensity in the ultra-violet range than sunlight. This method is not intended to cover the testing of materials ordinarily classed as hard or semihard rubber. The calibration method is intended primarily for use in measuring the intensity of radiation from the light sources used in connection with D 750.

These new tentative standards will be included in the 1943 Supplement to the Book of Standards, Part III, and will also be included in the Special Compilation of Rubber Standards (publication date late in December) and they will be available separately in a few weeks.

While the change in ES-6, formerly covering rubber sheath compound for electrical insulated cords and cables where extreme abrasion resistance is not required, seems relatively minor (elongation at rupture, change from 350 to 300 min. per cent), it has the effect of making the requirements applicable to the GR-S type of sheath com-

See pages 64, 65 for Emergency Alternate Provisions

pound. Thus ES-6 as originally issued was a specification for rubber which is not now available but as now modified ES-6a covers the GR-S synthetic compound.

Perhaps the most important of the changes made in testing asphalt composition battery containers involves the determination of manganese which is extremely important in this product. All the changes are considered improvements over the present techniques.

In the methods of chemical analysis, D 297, in which field Committee D-11 has done outstanding work, a new method has been added covering the direct determination of rubber hydrocarbon which heretofore has been estimated by difference. The new method was published in the January, 1943, ASTM BULLETIN and has been widely used during the past year, particularly for determining the rubber hydrocarbon value of reclaimed rubber.

Changes in the test for materials in liquids, D 471, establish three standard oils for use in immersion tests covering a range of swelling characteristics. Only one has been given heretofore. This is a definite improvement and is badly needed.

Since information recently developed indicates that properties of compressed asbestos sheet packing covered in D 733 are affected by moisture absorption, it is important that there be included specific details of conditioning of specimen before testing. Consequently provision has been inserted for conditioning in an oven at 212 F. for one hour followed by cooling to room temperature in a desiccator.

1944 Spring Meeting and Committee Week in Cincinnati, Week of February 28

Technical Groups Will Participate in Committee Week; Outstanding Symposium in Prospect for Spring Meeting on Synthetic Rubbers and Their Uses

THROUGHOUT THE week beginning February 28, 1944, probably extending through Friday, March 3, A.S.T.M. Committee Week will be in progress at the Netherland Plaza in Cincinnati, Ohio, and on Wednesday or Thursday the 1944 Spring Meeting will be held featuring what promises to be an outstanding technical symposium on synthetic rubbers and their uses, aimed to furnish latest reliable data to users of synthetic rubber products, to aid in proper application, precautions to be taken, expected service, and such problems.

Arthur W. Carpenter, Manager, Testing Laboratories, The B. F. Goodrich Co., Akron, Ohio, is serving as chairman of the Symposium Committee, announced later.

This will be the first national meeting of the Society held in Cincinnati and the selection of this leading city, which is the center of a great industrial area, is in partial recognition of this situation, plus the fact that A.S.T.M. has quite a number of active members in the 100-mile area around Cincinnati comprising parts of Ohio, Indiana, and Kentucky. Within a radius of 25 miles are located many of the country's largest manufacturing establishments and a circle at a hundred-mile radius would encompass an area including such communities as Columbus, Dayton, Lexington, Louisville, Middletown, and others. (Further information about Cincinnati is given later.)

TECHNICAL PROGRAM—SPRING MEETING

Rather complete details of the extensive symposium on synthetic rubbers and their uses will appear in the January, 1944, BULLETIN including a list of technical papers and authors, and related information. There has been considerable discussion of the importance of providing latest information on synthetic rubber and its uses as distinct from manufacturing technique and many of the members of Committee D-11 have indicated the great inherent value in such a project. Accordingly, the matter was discussed with officials in the Rubber Director's Office and there were received further acknowledgments of the worthwhileness of such a symposium.

In the pressure of getting synthetic rubber products, there has been a paucity of authentic information on application in various services. While some rubber technologists acknowledge that in many fields there is still inadequate information, the symposium will afford a means of passing along to consumers as much data as we now have. There is a very urgent and persistently increasing

Cincinnati Skyline, Showing Ohio River, Covington Bridge, Carew Tower and Netherland Plaza (two highest structures)

demand for reliable knowledge on applications and nowhere has there been compiled an authoritative presentation.

A symposium committee, including many active members of the Society and D-11 on Rubber Products has been appointed, and it will be noted from the following personnel that leading manufacturers and large consumers of rubber products are represented.

SYMPOSIUM COMMITTEE

Chairman: Arthur W. Carpenter, Manager, Testing Laboratories, The B. F. Goodrich Co.

S. Collier, Manager, Inspection and Control Dept., Johns-Manville Corp.

H. L. Ebert, Chief Chemist, Mechanical Goods, Firestone Tire & Rubber Co.

H. M. Frecker, Jr., Assistant Manager, Mechanical Goods Development, United States Rubber Co.

W. H. Gardner, representing Committee E - 6 on Papers and Publications.

Oliver M. Hayden, Manager, Rubber Chemicals Division, E. I. du Pont de Nemours Co., Inc.

J. H. Ingmanson, Vice-President, The Whitney Blake Co.

E. G. Kimmich, Mechanical Goods Development, The Goodyear Tire & Rubber Co.

Irving E. Lightbown, Stanco Distributors, Inc.

S. Maner Martin, Jr., Development Manager, Thiokol Corp.

W. J. McCortney, Engineering Dept., Chrysler Corp.

W. D. Parrish, Technical Service Manager, Hycar Chemical Co.

Gerald Reinsmith, Office of the Chief of Ordnance, U. S. Army

G. H. Swart, The General Tire & Rubber Co.

T. A. Werkenthin, Bureau of Ships, U. S. Navy

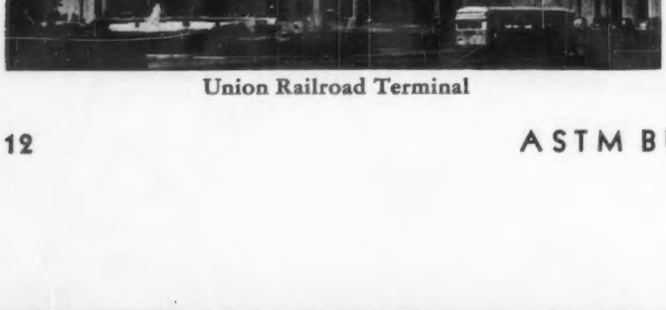
A.S.T.M. COMMITTEE WEEK

As indicated, 1944 Committee Week will be held from Monday, February 28, through Friday, March 3. There is assurance that a number of the committees will have meetings at this time, in many cases with subcommittees meeting also. A list of committees which plan to convene will be included in the January BULLETIN and each committee member will receive a notice well in advance.

HOTEL AND RAILROAD RESERVATIONS

Early in February there will be mailed to members and committee members a hotel reservation form, but meanwhile if members wish to write to the Netherland Plaza management reserving rooms, this is in order—it is suggested members indicate their attendance at the A.S.T.M meetings. The Society has been assured of sufficient room accommodations to take care of members' needs.

It is probably trite, unnecessary, and puerile, to remind members to make their railroad reservations early—but do it!



Union Railroad Terminal

Cincinnati—Some History

WITH A POPULATION in its city limits of about 460,000 (about 795,000 including the metropolitan area), Cincinnati, where the 1944 Spring Meeting and A.S.T.M. Committee Week will be held, is one of America's great industrial centers. It has a most interesting history tying in with Indian wars, America's westward march and transportation and industrial development and has some rather unique distinctions.

In a normal period, Cincinnati was credited with being the world's largest producers of machine tools, of soap, and of playing cards, but many other leading industries have large establishments there.

Apparently, one John C. Simes, Congress member from New Jersey, with Benjamin Stites, a Pennsylvania trader, were responsible for the first settlement there in November, 1788, at Maysville, which is just west of Cincinnati proper. The second settlement, opposite the mouth of the Licking River, is now the principal business district. The city—then a fortification—was named in 1790 in honor of the Society of the Cincinnati, a Revolutionary War Officers organization. While many factors were responsible for its rapid growth, one certainly predominates, that of its location on the Ohio River, and the development of river commerce. The steamboat contributed a great deal to the industrial advancement of Cincinnati. The first trip from Cincinnati to Pittsburgh was by keelboat in 1794 (the boats were apparently well-armed as protection against Indians). In 1811 the first steamboat docked at Cincinnati on its way from Pittsburgh to New Orleans. From then on, Cincinnati's shipping and steamboat building flourished, thus beginning a great import and export trade route with the deep South. Later, with the building of the Miami-Erie Canal, which stretched from Cincinnati to Dayton (completed to Toledo on Lake Erie 1845) Cincinnati commerce again increased.

The completion in 1880 of the only large municipally owned railroad, the Cincinnati Southern line to Chattanooga, occasioned by the Louisville and Nashville Railroad taking much of the traffic through Louisville, was a major industrial factor.

Industries:

Mention of some of the great companies with their huge plants in the Cincinnati area will indicate the scope of its industries—many of the following groups have been very active through their technical representatives in A.S.T.M. A list of such companies would include the following:

Eagle-Picher Lead Co.	The William Powell Co.
Cincinnati Milling and Grinding Machines, Inc.	Lunkenheimer Co.
Crosley Corp.	Pollak Steel Co.
Formica Insulation Co.	American Rolling Mill Co.
	Andrews Steel Co.

Schools, etc.:

The University of Cincinnati, in normal times with an enrollment of about 10,000, is notable among other things, for the sponsorship, about 1910, of the cooperative system of education (Northwestern Technical Institute at Evanston is the latest to follow this system which involves periods of alternate work in industry with study). St. Xavier University was founded in 1831. The Ohio Mechanics Institute, the first trade school of its kind west of the Alleghenys was established in 1828.

Structure and Creep Characteristics of Cast Carbon-Molybdenum Steel at 950 F.*

By H. E. Montgomery[1] and John Urban[1]

SYNOPSIS

Interrupted quenching has been utilized to obtain pearlitic and acicular structures in both fine-and coarse-grained cast carbon-molybdenum steel. This eliminated the effect of grain size when comparing the creep-resisting properties of the different structures or *vice versa*. Creep tests have been made on specimens with these structures at a temperature of 950 F. and a load of 12,000 psi. for comparative purpose. The creep tests show that the coarse-grain acicular structure is the best in creep-resisting properties and the fine-grain pearlitic the poorest.

The relationship of creep characteristics to certain structures in carbon-molybdenum cast steel has been investigated in connection with more extensive laboratory studies of the various effects of heat treatment on structural and physical properties by the Lunkenheimer Co.

It is current opinion that (other conditions alike) a coarse-grain metal usually has higher "creep resistance" than a fine-grain one. It has been shown by White and Crocker[2] that an acicular structure may possess higher "creep resistance" than an ordinary pearlitic structure. This conclusion was arrived at independently by the authors at about the same time, as applying to a nickel-chromium-molybdenum cast steel (grade WC4).[3] This latter work was not published, although reference to it was made in discussion of the White and Crocker paper.

This paper shows the effects of the following structural combination in cast carbon-molybdenum steel (grade WCl)[3] on creep and other physical properties. The steel used was of the following composition:

Carbon, per cent	0.26
Silicon, per cent	0.40
Manganese, per cent	0.64
Phosphorus, per cent	0.025
Sulfur, per cent	0.032
Molybdenum, per cent	0.50
Nickel, per cent	0.08
Chromium, per cent	0.01
Copper, per cent	0.08
Aluminum, total,[a] per cent	0.085
Aluminum, as oxide, per cent[b]	0.026

[a] Aluminum was determined as total by the method of Lundell, Hoffman, and Bright, "Chemical Analysis of Iron and Steel," p. 248. John Wiley and Sons, Inc., New York, N. Y. (1931).

[b] Aluminum as oxide was ascertained by combined method of above reference and that outlined in "Sampling and Analysis of Carbon and Alloy Steel," by chemists of United States Steel Corp., p. 204. Reinhold Publishing Corp., New York, N. Y. (1938).

The steel was so treated that it was either entirely in the acicular condition with no ferrite grains, or in the pearlitic condition (Figs. 1 to 4). By using the structures so obtained it was felt that the relative creep-resisting characteristics of each could be ascertained.

Laboratory heat treatments used to produce the desired structures and the corresponding room-temperature physical properties are shown in Table I. All of the coupons had a preceding preliminary treatment of 5 hr. at 1800 F., furnace cooled to 1600 F., air quenched, followed by 1600 F. for 5 hr. and air quenched.

By acicular structure we refer to a transition product intermediate between pearlite-ferrite (quasi-stable) and martensite (unstable). Such a structure is shown in Fig. 1 at 500 magnifications.

By grain size we refer to ferrite grains, pearlitic patches, and acicular areas, the last as outlined by change in direction of the carbide plates using the A.S.T.M. Tentative Classification of Austenite Grain Size in Steels (E 19 – 39 T)[4] as the unit of measurement.

The structures shown in Figs 1 and 2 are considered coarse grained, those in Figs. 3 and 4 fine grained. To delineate other grain size more clearly the right half of Figs. 1, 2, 3, and 4 have been prepared by outlining the grains on tracing paper and making prints from the paper. The cross-hatched areas indicate pearlitic patches. It will be noted that the treatment No. 115 gave a mixed structure with coarse pearlitic and a medium size ferrite.

Creep curves for the various treatments are shown in Fig. 5. Very great differences in behavior in creep occur.

At the same temperature (950 F.) and load (12 000 psi.) the relative order of merit in sustaining load is:

Treatment	Structure	Creep Rate, per cent per 100,000 hr. over 500 hr. to 2000 hr.
No. 114	Coarse acicular	1
No. 112	Fine acicular	3.5
No. 115	Coarse pearlitic	7.5
No. 113	Fine pearlitic	48.

In this case the acicular structures effect seem to outweigh the effect of grain *per se*, although in each case (acicular and pearlitic) the coarse grain is superior for a given intragranular structure. Table II shows properties on creep bars after test.

War conditions have prevented extensive follow up of this work. The particular tests herein reported were carried out under carefully controlled conditions. Preceding studies here had indicated that what is described in this paper might well have been expected. Under commercial manufacturing conditions it had been noted that an occasional heat, with the acicular structure predominating and relatively low ductility, would show very high creep strength. Suitable retreatment would bring the metal up to the ductility requirements of specifications. Observation by Bolton and Montgomery some ten years or so ago[5] indicated that certain nickel-chromium-molybdenum steels

* Presented at Forty-sixth Annual Meeting, Am. Soc. Testing Mats., Pittsburgh, Pa., June 28–July 2, 1943.

[1] Metallurgical Dept., The Lunkenheimer Co.

[2] A. E. White and Sabin Crocker, "Effect of Grain Size and Structure on Carbon-Molybdenum Steel Pipe," *Transactions*, Am. Soc. Mechanical Engineers, Vol. 63, No. 8, November, 1941, p. 749.

[3] Tentative Specifications for Alloy-Steel Castings Suitable for Fusion Welding for Service at Temperatures from 750 to 1100 F. (A 217 – 42 T), 1942 Book of A.S.T.M. Standards, Part I, p. 1006.

[4] 1942 Book of A.S.T.M. Standards, Part I, p. 1934.

[5] Not published.

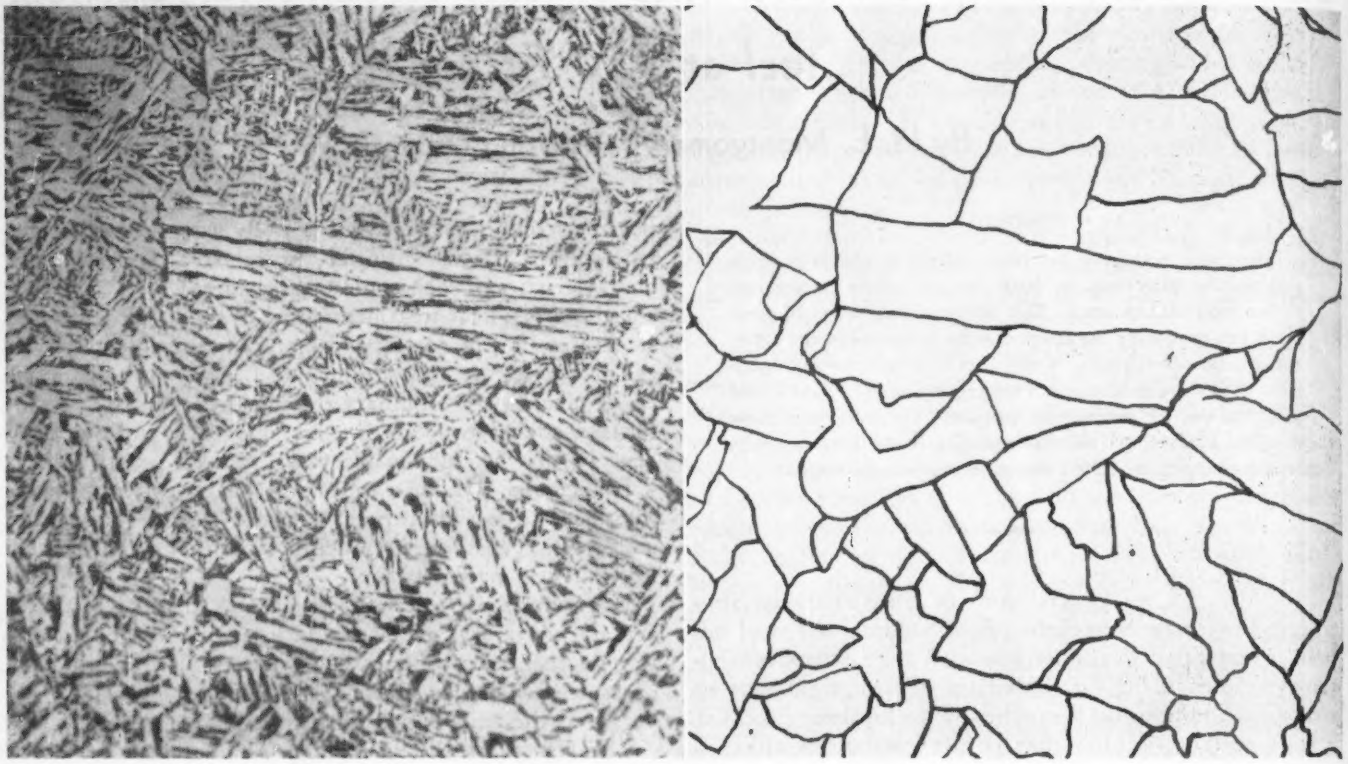


Fig. 1.—Coarse-Grain Acicular.

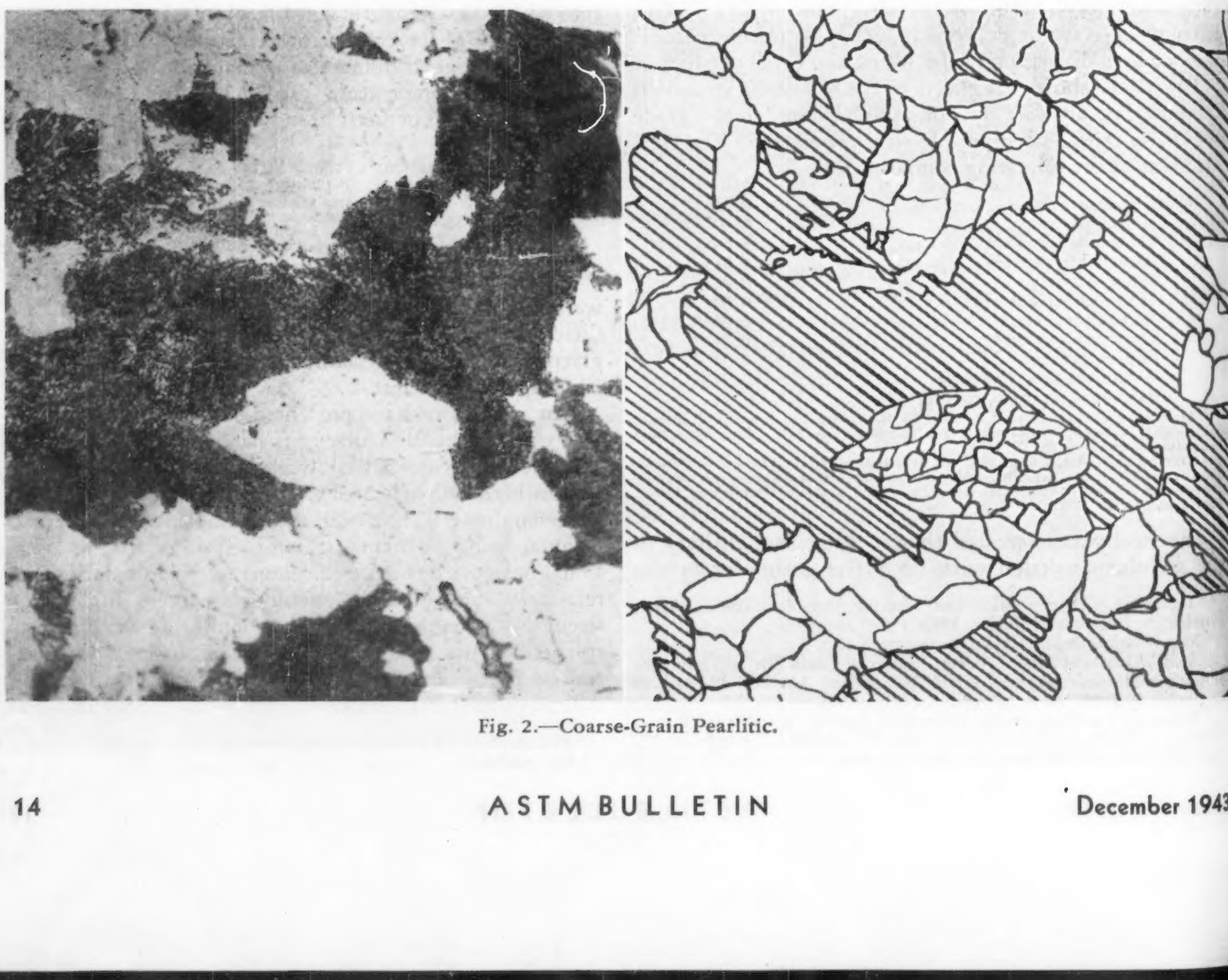


Fig. 2.—Coarse-Grain Pearlitic.

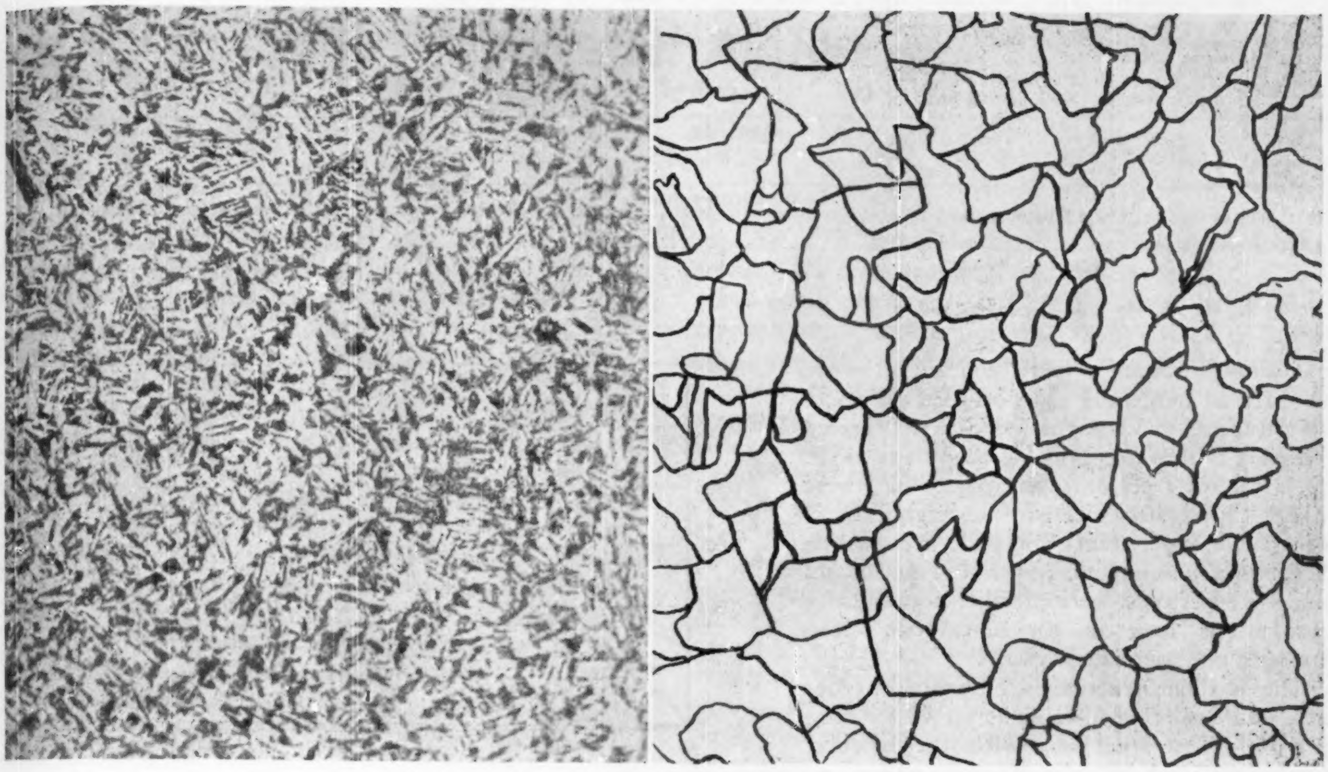


Fig. 3.—Fine-Grain Acicular.

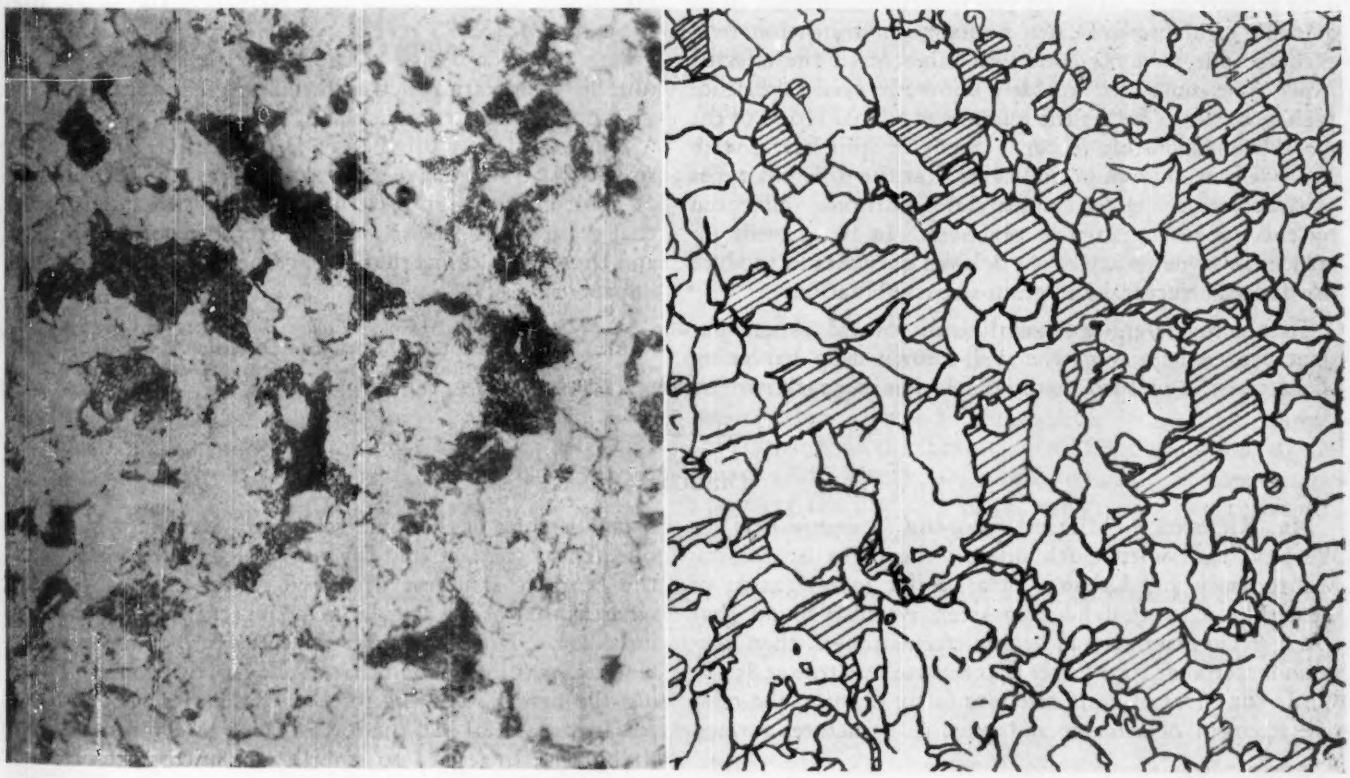


Fig. 4.—Fine-Grain Pearlitic.

TABLE I

Treatment	Grain Size, Avg.	Microstructure	Yield Strength, psi.	Tensile Strength, psi.	Elongation, per cent	Reduction of Area, per cent	Brinell Hardness Number
No. 112 {1600 F., 3 hr. Quench into tin at 800 F., hold 2 hr. Draw at 1200 F., 5 hr.}	8	Acicular	80 700	100 700	16.3	36.0	196
No. 113 {1600 F., 3 hr. Quench into tin at 1200 F., hold 5 hr.}	8	Pearlitic	61 000	80 000	22.0	34.1	159
No. 114 {2000 F., 5 hr., cool to 1600 F. Quench into tin at 800 F., hold 2 hr. Draw at 1200 F., 5 hr.}	4 to 5	Acicular	71 000	93 200	17.3	38.8	212
No. 115 {2000 F., 5 hr., cool to 1600 F. Quench into tin at 1200 F., hold 5 hr.}	5	Pearlitic	55 400	76 000	26.4	44.9	159

TABLE II.

Treatment	Microstructure	Rockwell Hardness		Tensile Strength, psi.	Elongation, per cent	Reduction of Area, per cent
		Before Creep	After Creep			
No. 112........	Fine grain acicular	B 90	B 91	99 700	17.4	34.1
No. 113........	Fine grain pearlitic	B 82	B 83	81 000	25.6	47.5
No. 114........	Coarse grain acicular	B 93	B 95	97 500	16.5	37.[illegible]
No. 115........	Coarse grain pearlitic	B 84	B 85	81 500	22.0	42.5

containing about 1 per cent nickel were slightly air hardening and possessed an acicular structure. When this condition occurred very high creep strengths (30,000 psi. at 900 F. for a rate of 1 per cent per 100,000 hr.) were likely. Elongations were in the neighborhood of 15 to 18 per cent. Suitable treatments, keeping carbon under 0.30 per cent and nickel under 1.0 per cent, were effective in producing elongations over 20 per cent, with creep strength of about 22,000 psi.

The acicular structure is a transition product, and has proved stable at 950 F. for long periods. Test specimens with the acicular structure have been tested in creep at 1000 F. under loads that gave 2.5 per cent in 100,000 hr. The structures showed no breakdown at the 1000 F. temperatures in 2500 hr. (total time of test) as evidenced both by structural examination and by hardness tests.

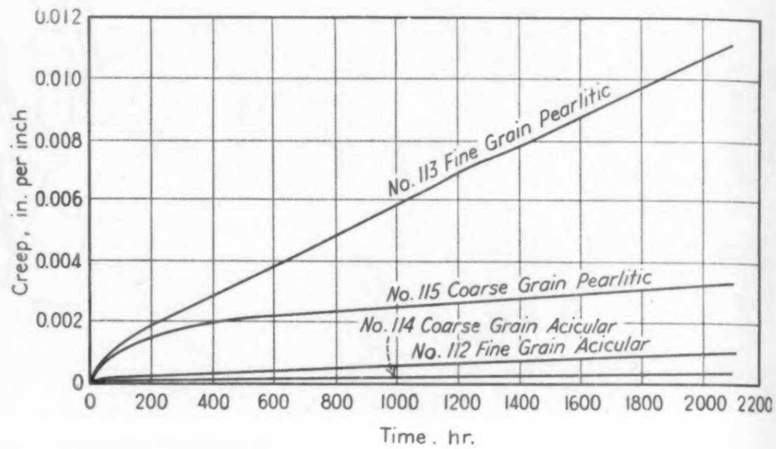


Fig. 5.—Cast Carbon-Molybdenum Steel, 12,000 psi. at 950 F.

In regular manufacturing practice the occurrence of an acicular structure indicates a change in transition temperature due to some condition inherent in the affected heat. The causes are not fully known but our experience is that reactions during the refining and deoxidation of the metal are responsible in part. Study of split heats, with and without aluminum, indicates that the different types of structure are (under commercial conditions) influenced by this type of change in practices. In the present instance it was necessary to use delayed quenches to produce the desired structural and grain-size combinations.

That a coarse-grained metal tends toward an acicular structure concurs with the well-known deep hardening characteristics of such material. It has been shown by Davenport and associates[6] that increasing the grain size tends to shift the "S" curve to the right, thus necessitating greater time for transformation. With a given cooling rate the temperature of transformation is lowered thereby to a point where the acicular structure is an end product.

It is hoped that this paper (less extensive than we desire) will be suggestive as to approaches toward solution of controversies now existing between those who hold that grain size is the predominent factor in creep resistance and those who think that intragranular structure is more important.

[6] E. S. Davenport, R. A. Grange, and R. J. Hafster, "Influence of Austenitic Grain Size Upon Isothermal Transformation Behavior of S.A.E. 4140 Steel," *Transactions*, Am. Inst. Mining and Metallurgical Engrs., Iron and Steel Division, Vol. 145, 1941, p. 310.

DISCUSSION

Mr. Richard F. Miller[1] (*presented in written form*).—We have read with much interest the paper by Messrs. Montgomery and Urban. In a similar investigation of wrought carbon-molybdenum steel, we also found that coarse-grain material had higher creep strength than fine-grain material at 1000 F, yet that reverse was true at 850 F. While the effect of grain size was fairly definite, the relative strength of acicular and pearlitic structures formed from austenite of the same grain size was somewhat complicated by the fact that for a given load the creep rate of the pearlitic structure decreased as the test progressed, whereas that of the acicular material remained the same or increased. Thus, although the creep rate of the acicular material was lower than that of the pearlitic material during the first part of the test, at the end of 3000 hr. the pearlitic material had the lowest creep rate (highest creep strength). In regard to stability of microstructure, we noticed a slight amount of spheroidization in all of the specimens after the 3000 hr. creep tests at 1000 F.

[1] Research Laboratory, United States Steel Corp. of Delaware, Kearney, N. J.

The Use of Photoelectric Spectrophotometric Techniques in Chemical Analysis[1]

By J. W. Stillman[2]

For many years the practice in analytical chemical procedure was divided into two broad fields: gravimetric analysis and volumetric analysis. Then another classification called colorimetric analysis was added because in many cases the intensity of the color developed in the analytical reaction permitted the determination of elements which were present in much lower concentration than could be determined by either of the other two types of analyses. More recently the analyst has increasingly availed himself of the techniques of physics and physical chemistry to improve the accuracy of his work. The trend will be toward even greater use of methods based on physical principles because these new methods will be less time consuming than the old tedious procedures and because bv them it will be possible to solve the more complex problems faced by the analyst today which often cannot be handled by the more conventional methods.

It is the intention to give a brief survey of the field of spectrophotometry as applied to analysis with the hope that it will stimulate interest in this technique and will result in a study of the available literature which is necessary in order to obtain a complete understanding of the subject.

It is desirable, as an introduction to this subject, to clarify some of the terms used. To the analyst "colorimetric analysis" has a very definite meaning. It refers to the determination of an element or group of elements by means of the intensity of a color developed in a controlled reaction. The physicist, on the other hand, speaks of "color analysis" and means the determination of the characteristics of the color as well as the intensity. Attention will be directed to the former conception in this discussion, but it will be necessary to consider somewhat the approach of the physicist if full advantage is to be taken of his technique.

Colorimetric methods are based on the fact that the element or compound being determined forms with the reagent a color, the intensity of which is dependent on the concentration of the unknown. Colorimetric methods are not new, and yet, full advantage of them has not been taken until recently. Standard textbooks of analytical chemistry of twenty-five to thirty years ago did not mention procedures based on color intensity. As has already been mentioned, advantage was first taken of these techniques to extend the sensitivity of analytical methods to lower concentrations than could be used for volumetric and gravimetric procedures. Today colorimetry is well established as a subsidiary classification of analytical chemistry, although much work remains to be done to improve the details of the technique and the design of the instruments to be used with it. Great progress in this direction has been made in the past five years.

In a colorimetric analysis, the procedure has been to carry out the color-forming reaction with the unknown and at the same time and under identical conditions to prepare a set of standards containing known amounts of the element being determined in several different concentrations. The intensity of the color produced with the unknown was compared visually with the color produced with the standards, using for the purpose a set of Nessler tubes. From the concentration of the standard whose color matches that of the unknown, the concentration of the element being determined in the unknown was calculated.

In order to make the matching of the color easier, a number of instruments have been introduced but still based on the visual method and subject to its limitations. The first photoelectric instruments attempted to substitute the photoelectric cell for the human eye, but retained the rest of the visual instrument intact. It became evident that this was unsatisfactory and that to be successful, the photoelectric instrument must be designed on a sound theoretical basis.

It is of interest to note that analytical chemists working in the more or less conventional fields of inorganic and organic chemistry have been slow to make use of photoelectric techniques for the measurement of color intensity. Reference to the literature shows that biological chemists recognized the possibilities of photoelectric instruments and applied them extensively to their problems. In fact most of the early photoelectric colorimeters, so called, were based on design suggested by workers in the biological field.

Before considering these colorimetric procedures, a few definitions are necessary:

Spectrophotometer.—An instrument by means of which the absorption of a sample may be measured at any wave length in a specified spectral range. Such instruments consist essentially of a spectrometer plus a photometer. The former is an instrument for isolating radiations of the desired wave length, and the latter is an instrument for measuring the intensity of the radiation. Visual, photographic, photoelectric, or thermoelectric methods of measurement may be used.

Colorimeter.—In the strict sense, an instrument for measuring the color of light (reflected from or transmitted by a substance or emitted by a light source) under certain conditions. The term colorimeter when applied to an instrument such as the Duboscq is incorrectly used because this is really a color comparator.

Most photoelectric instruments are absorptiometers, that is, instruments for measuring the absorption of a sample using "white" light or light of a chosen restricted

NOTE.—DISCUSSION OF THIS PAPER IS INVITED either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Contribution No. 198 from the Chemical Department, Experimental Station, E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.

[2] Head of the Analytical Division, Chemical Department, Experimental Station, E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.

spectral range. When a series of spectral ranges is used the instrument becomes an "abridged spectrophotometer."

These definitions have been taken from *The Analyst* (*9*)[3] and were drawn up by a special committee. Other important definitions exist which, however, are not of concern in this discussion.

In a satisfactory colorimetric method certain requirements must be met, and upon the degree to which they are met depends the suitability of the method for quantitative analytical use. These requirements include the following:

The color produced by the reagent must be characteristic of the element or group being determined. Otherwise any other elements or groups giving the same or similar color will have to be absent.

The color must be produced in reasonable intensity by small amounts of the element or group being determined. In other words, it must be a sensitive reaction.

The color produced must be stable for a sufficiently long time to permit the necessary manipulations and the measurement of the color intensity. Any change in color during a short period would lead to erroneous results.

The color should not be influenced by the presence of salts in the solution such as result from the treatment of the sample. Of course this effect can be compensated for by adding the same salts in the same concentration to a blank.

The density of the color produced should be proportional to the concentration of the element or group being determined. This is spoken of as conformity to Beer's law. The Lambert-Beer law, as it is more properly called, is the outgrowth of the work of several men, of whom Bouguer in 1729 was the earliest. The mathematical expression for this law is as follows:

$$I = I_0 10^{-kcl}$$

where:

I_0 = intensity of the incident light,
I = intensity of the emergent light,
k = molecular extinction coefficient,
c = concentration in moles per liter, and
l = length of solution through which the light passes in centimeters.

The molecular extinction coefficient k is a physical constant dependent upon the molecular structure of the substance. For any wave length and any given system, the value of k should be constant at all dilutions and all thicknesses of absorbent. Since all other values in the above equation can be determined, the value of k can be calculated.

Certain familiar terms used in spectrophotometry are defined by reference to the Lambert-Beer law.

$$I/I_0 = \text{transmission } T$$

$$\log I_0/I = \text{optical density } D = \text{extinction } E$$

These latter terms are synonymous. By rearrangement of the Lambert-Beer equation we obtain

$$\log I_0/I = E = kcl$$

From this it will be seen that the extinction value is directly proportional to the concentration. In plotting a curve of the values for the transmission of solutions at different wave lengths, extinction values *versus* wave length are often plotted rather than transmission *versus* wave length.

In the study of a colorimetric method, the first step is to determine the characteristics of the color produced by the reagent and the element or group being determined. This is done by determining the transmittancy of the colored solution at different wave lengths. To do this accurately a spectrophotometer is required which will give light of different wave lengths of reasonable purity. The broader the band of wave lengths selected, the less accurate will be the transmittancy values obtained. This is important, especially in those cases where sharp changes in transmittancy occur with changes in wave length. From the data thus obtained a transmittancy curve can be drawn by plotting transmittancy (or extinction values) against wave length. If desired, similar curves for different concentrations of the element or group being determined can be obtained. From these curves the wave length at which maximum absorption takes place is selected for use in the analytical determination. The wave length of maximum absorption is not necessarily the optimum point for analytical use. One of the principal advantages of spectrophotometry in applied analytical colorimetry is the possibility of resolving color systems containing two or more color components and measuring the intensity of the particular component in question. In some cases it may be advantageous to obtain calibration curves at different wave lengths, in order to measure the transmittancy of the test solution under the optimum conditions with respect to the concentration of the element present in the solution.

At this wave length the transmittancy values corresponding to different concentrations of the element or group in question are determined, and a calibration curve is drawn by plotting the logarithm of the percentage transmittancy against concentration. Once this has been done it is only necessary, in making an analysis, to determine the transmittancy for the unknown at the given wave length and refer to the calibration curve and read off the concentration.

Of course, to complete the study, the effect of possible interfering ions on the color and its characteristics should be determined. Considerable work along this line is being done, and the literature contains many excellent papers reporting the results of colorimetric studies and recommending suitable conditions for analytical methods. The future promises to see wide use of this technique.

It is impossible, within the scope of this paper, to give a detailed description of the instruments now on the market, and any such evaluation would soon be out of date because new developments are being made regularly. It is possible, however, to give the basic characteristics of the different types of instruments available.

For research and method-development work, a spectrophotometer should be selected. This will consist of a light source, an optical system for transmitting the light through the instrument and for separating the light into its constituent wave lengths, and a photoelectric system for measuring the intensity of the light beam which emerges from the sample. For separating the light into different wave lengths, some instruments use a prism and others a grating. By focussing the spectrum obtained

[3] The italic numbers in parentheses refer to the reports and papers appearing in the list of references appended to this paper.

from the prism or grating on a slit and moving the spectrum past the slit by rotating the prism or grating, the desired wave length can be selected. For accurate work it is essential that only light of the desired wave length pass through the slit to the sample. The width of the slit is adjustable, and the narrower the slit, the narrower will be the spread of wave lengths in the emergent light. In practice there must be a sufficient intensity of light to measure satisfactorily, and this places a lower limit on the width of slit that can be used. Precautions are also taken so that no stray light reaches the slit. The optical system is enclosed in a light-tight box, and baffles are set at appropriate points to block any stray light. By using a second grating as a sort of optical screen, one manufacturer reduces the amount of stray light. In the photoelectric system, photosensitive tubes are used to measure the intensity of the emergent light. The current from the phototube will operate an indicating instrument which can be calibrated in percentage transmission based on a standard sample, or the current can be used to operate a recording device. A spectrophotometer such as described can be used for routine determinations which are based on color reactions, and, in addition, will yield complete information on light transmission or absorption for the entire wave length scale covered by the instrument. An incandescent light bulb will give a continuous spectrum in the visible region. A hydrogen discharge tube will give a continuous spectrum through the ultraviolet region. In the latter case, the optical system must be designed to transmit the ultraviolet wave lengths.

As can be easily understood, an instrument to give the utmost in accuracy will be expensive, and the cost cannot be justified for many routine applications. To meet this situation, there are many photoelectric instruments on the market which are of simpler design. For the selection of the wave length, filters are used which transmit a narrow band of wave lengths. If the instrument is provided with a set of carefully selected filters covering the complete range of wave lengths, it can be properly called an abridged spectrophotometer. If the instrument with filters is also equipped with a mercury vapor lamp which gives a line spectrum instead of the continuous spectrum of the incandescent lamp, reasonably pure light of the different wave lengths corresponding to the mercury vapor lines will be obtained.

Many of the instruments on the market are designed to give the best possible service consistent with a comparatively low cost. If such an instrument is to be applied to routine work and is calibrated under the same conditions under which it is to be used, satisfactory results should be obtained.

In the following list of references are listed a number of general papers which discuss in detail the field of spectrophotometry. Müller's article (*5*) describes very thoroughly the theoretical basis for instrument design.

For a listing of typical examples of applications of spectrophotometry to the determination of metals, it is suggested that reference be made to the "Bibliography of Photoelectric Spectrophotometric Methods of Analysis for Inorganic Ions" compiled by the author which is obtainable from the A.S.T.M. headquarters.

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(*3*) B. W. Story and V. A. Kalichevsky, "Photoelectric Colorimeter for Measuring Color Intensities of Liquid Petroleum Products," *Industrial and Engineering Chemistry*, Analytical Edition, Vol. 5, p. 214 (1933).

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(*9*) A. E. Gillam, G. F. Lothian, R. A. Morton, and B. S. Cooper, "Spectrophotometric Terms and Symbols," *The Analyst*, Vol. 67, p. 164 (1942).

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[Editor's Note—The following two abstracts of papers, prepared with some help from the speakers, deal with specific phases of industrial utilization of farm products and should be of interest to wide segments of the membership.]

Abstract of Paper on

Artificial Bristles from Casein[1]

The speaker pointed out that casein as well as other proteins can be made into a ductile and plastic material by heating with water and other agents, which has long been known. The extrusion and shaping of these materials is principally described in an extensive patent literature and is the basis of the protein plastics industry.[2] Two methods—a wet and a dry process—are used in making casein plastics. Water is used in both these methods, but in the wet method relatively larger quantities of water are used, as well as solution in alkali followed by subsequent neutralization with acid. Rennet casein is generally used in making plastics by the dry method and acid casein by the wet method. In the commercial development of protein plastics the extrusion of relatively thick rods or tubes has been frequently used as a step in the manufac-

[1] Presented by Dr. T. L. McMeekin, Eastern Regional Research Laboratory, Philadelphia, Pa., at a meeting sponsored by the A.S.T.M. Philadelphia District Committee, Franklin Institute, September 23, 1943. This laboratory is part of the Agricultural Research Administration, Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture.

[2] Brother, Chapter 7 of "Casein and Its Industrial Applications," by Sutermeister and Browne. Second edition. Reinhold Publishing Corp., N. Y., 1939.

ture of articles. Millar[3] in 1898 showed that proteins could also be made into filaments for textile purposes by extruding heated protein-water mixtures into air. At about the same time it was shown by Todtenhaupt[2] that textile fibers could be prepared by extruding concentrated alkaline solutions of casein into an acid bath. Improvements in the latter method during recent years have led to the development of a commercial textile fiber from casein.[2]

To produce protein plastics, formaldehyde and other tanning agents are invariably used to make the product more durable and resistant to water. Hardening agents are only partly successful, however, in reducing the water absorption of proteins, and the loss of strength and shape of manufactured protein products in the presence of water limits their use.

In the method employed at the Eastern Regional Research Laboratory for preparing casein fibers of the size of bristles and other coarse animal hair, isoelectric casein containing approximately 45 per cent water is extruded into air, with subsequent stretching and hardening under tension. The strength, durability, and flexibility of the casein fibers are markedly increased by treating them while under tension with quinone solutions followed by formaldehyde. Many other hardening agents have been tried, such as aluminum, chromium, and iron salts as well as natural tanning substances, but these substances did not improve the fibers sufficiently to justify their use. In determining whether an added substance was beneficial, its influence on the tensile strength, flexibility, and water absorption of the fiber was evaluated.

Preparation of Fibers

In preparing casein fibers, both highly purified casein and commercial casein have been used. Several representative commercial caseins gave fibers of about the same quality as the highly purified casein. A small amount of fat in the commercial casein does not seem to injure the fiber. Not all commercial caseins, however, are suitable for fiber extrusion. Some of the requirements of a casein for extrusion into fibers are as follows: (1) The pH of an aqueous extract should be between 4.5 and 4.9; (2) the solids content of the aqueous extract should be low, indicating that the casein had been well washed; (3) the casein should dissolve easily in 2.5 per cent borax, and such solutions should have a low viscosity, indicating that the casein had not been injured by too much heat during drying.

The most satisfactory procedure developed thus far for making casein fibers consists in mixing 80-mesh casein with enough water to make the water content about 45 per cent and allowing the mixture to stand for an hour, or more, to become swollen. In some cases it may be desirable to knead in a heated mixer; the time of heating, however, should be kept to a minimum to avoid overheating. The swollen casein, containing 45 per cent water, is heated to 95 to 100 C. and then converted into fibers by forcing through a die with holes of a suitable diameter. Orifice diameters from 0.3 to 1.0 mm. are generally used. A discontinuous cylinder type of press is used to force the casein through the die. It seems likely, however, that a continuous type of screw press could be used for this purpose. The use of breaker plates in the extrusion is a great advantage in mixing and in the removal of air.

The extruded fibers are passed over rotating drums to produce tension, which stretches the fibers. To minimize sticking, the fiber is passed rapidly through a solution containing 2 per cent formaldehyde, 0.1 per cent of a naphthalene sulfonate, and 10 per cent sodium sulfate. The fibers are then wound on a suitable reel.

Stretching and Hardening

The fiber is cut off the reel and allowed to stand in a quinone solution for 30 min. in order to acquire sufficient strength to be stretched two or three times its original length. After this hardening treatment, the fiber is progressively stretched in the quinone solution to a length from 50 to 200 per cent greater than its initial length. The stretched fiber is held in the hardening bath long enough to attain its maximum water resistance. When a 1 per cent quinone solution is used at room temperature, the time required for this hardening is from 24 to 40 hr. Further hardening and reduced water absorption are obtained by allowing the fiber to stand under tension in a 2 per cent solution of formaldehyde for 24 hr. Finally, the stretched fibers are allowed to dry at room temperature. Quinone and formaldehyde can also be used separately as well as combined.

The effect of stretching on tensile strength and flexibility is shown in Table I. The testing was done at 65 per cent relative humidity and a temperature of 70 F. A standard Scott testing machine was used. The tensile strength of a fiber with a loop tied in it was used as a measure of flexibility.

TABLE I.—EFFECT OF STRETCHING CASEIN FIBER DURING HARDENING WITH QUINONE.

Extent of Stretch	Tensile Strength, g. per denier	Flexibility, g. per denier
None	0.67	0.56
1.24 times	0.69	0.62
1.58 times	0.78	0.66
2.50 times	1.00	0.23
2.96 times	1.20	0.20

It is seen that as stretching is increased, tensile strength and flexibility increase. A point is reached, however, where an increase in stretching reduces the flexibility. Stretching also increases the wet strength and slightly decreases the water absorption.

In making casein bristles, the fibers are usually stretched only twice their length in the quinone bath in order to obtain greater strength with the greatest flexibility rather than stretching to the greatest possible extent. This treatment results in a casein bristle of a dry strength of about 0.8 g. per denier under standard conditions and a wet strength of about 0.4 g. per denier after immersion in water for 4 hr. at 70 F.

Properties and Uses of Casein Bristles

After treatment with quinone and formaldehyde under tension, casein fibers are straight, cylindrical, and have a glistening black color. Occasionally the fibers are somewhat brown due to overheating or other causes, such as the use of old quinone solutions. Stiffness of the fibers varies with the diameter. Diameters between 0.1 and 0.6 mm. were used. The fibers with 0.1 mm. diameter are soft and flexible, while the 0.6-mm. diameter fibers are stiff.

[3] Millar, British Patent No. 6700, March 19, 1898; *Journal*, Soc. Chemical Industry, Vol. 18, p. 16 (1899).

The present shortage of pig bristle and horsehair has suggested the development of a fiber from casein of the size and properties of these natural hairs. These fibers are designated casein bristles as a matter of convenience and to imply possible uses. A number of brushes, such as paint, hair, shaving, and counter brushes, have been made of the casein bristle. Such brushes have a good appearance, and they are being tested to determine their usefulness. Casein bristles curl if they are allowed to stand in water and then are dried. Such curling can be partly overcome by allowing the brush to dry in a suitable form. Casein bristles are resistant to oils and fat solvents.

Casein bristles can also be formed into resilient coils by heating with steam or boiling water. On drying in air, this material has considerable springiness. This property suggests that the casein bristle may be of value in furniture stuffing and other forms of padding.

The casein fibers hardened with quinone and formaldehyde changed very little under laboratory conditions during a 12-month period. In an accelerated aging test to determine the stability of these fibers, samples were heated at 60 C. in a forced draught oven for 6 months. Periodically the fibers were removed and reconditioned, and the tensile strength and flexibility were then determined. It was found that the casein bristles deteriorated only slightly under these conditions.

Water Absorption of Casein and Other Protein Products

Casein fibers of 0.4 mm. diameter and weighing from 0.2 to 0.3 g. are convenient for water-absorption studies. The method described for the determination of the water content of β-lactoglobulin crystals[4] was used with slight modification. The water content of the casein fiber immersed in water was determined by weighing the wiped fiber on an analytical balance of the chainomatic type. The loss in weight with time was plotted, and the weight of the fiber at zero time was determined by extrapolation. The difference in weight between the final weight obtained after heating the fiber at 105 C. and the extrapolated weight obtained at zero time was considered to be the water content of the fiber. Unhardened casein fibers in equilibrium with water contained 42 per cent water. The water content after equilibrium was reached was independent of time or temperature between 4 and 25 C. Also the fiber dehydrated at 105 C. regained the original water content of 42 per cent on being reimmersed in water.

The water absorption of formaldehyde-treated fibers has been determined from a 2 per cent formaldehyde solution rather than from water, since it has been observed many times that formaldehyde-treated casein plastics continue to increase in weight with time when immersed in water.[5] The increase in weight of the formaldehyde-hardened casein fibers with time on immersion in water is in part due to the loss of formaldehyde by the casein. By determining the water absorption from 2 per cent formaldehyde solutions instead of water, it was found that the formaldehyde-casein fibers reached a constant weight. Table II summarizes the results obtained on the water absorption of casein and other proteins. It may be noted

TABLE II.—QUALITIES OF FIBER PREPARED FROM DIFFERENT PROTEINS.

	Untreated—Water Content After Immersion in Water[a] (22 to 25 C.), per cent	Formaldehyde-Hardened—Water Content After Immersion in 2 per cent Formaldehyde (22 to 25 C.), per cent	Lysine Content, per cent	Flexibility of Formaldehyde-Hardened Fibers
Casein	42	25	6.3	Good
Gelatin	93	58	5.9	Good
Zein	28	25	0.0	Brittle
Edestin	34	33	2.3	Brittle
Arachin	34	30	1.7	Brittle
Glutenin	60	51	1.9	Brittle
Soybean protein	45	26	4.9	Good

[a] Chloroform was used as a preservative.

that the water absorption of those proteins with a low lysine content is only slightly affected by formaldehyde and that fibers made from these proteins are brittle. Thus the most useful proteins for fiber formation contain a large proportion of lysine.

Discussion

The dry tensile strength of artificial casein bristles is approximately two thirds of the tensile strength of horsehair or pig bristle. Such strength is adequate for most uses as brush bristles. The injurious effects of water absorption by protein products is frequently commented on. Casein fibers hardened with quinone and formaldehyde contain only 18 per cent water after soaking in water for 24 hr., whereas natural protein fibers, namely, horsehair, silk fibroin, and wool, after soaking in water contain 21.8, 24.0, and 28.5 per cent of water, respectively.[6] The tensile strength of casein fiber soaked in water, however, is only about 50 per cent of the dry strength, whereas the tensile strength of the water-soaked natural protein fibers is approximately 75 per cent of the dry strength. Also, curling after wetting of natural protein fibers is not so pronounced as with the hardened casein fiber. It seems probable that these differences in properties between the natural protein fibers and casein fiber are largely due to physical differences in structure rather than differences in chemical composition.

Both quinone and formaldehyde markedly increase the flexibility of the casein fibers, but in this respect quinone is superior to formaldehyde. Hardening appeared best near the iso-electric point of casein. Quinones other than parabenzoquinone can also be used for hardening casein, but they do not appear to be so effective as ordinary quinone. Formaldehyde appears to be unique among the aliphatic aldehydes in hardening casein, since other members of the series have little influence on the water uptake of casein and on the wet tensile strength. Natural tannins, such as extracts of horsechestnut bark and quebracho, do not harden casein fibers; tannic acid, however, is an effective hardening agent and when combined with formaldehyde produces a well-hardened resistant fiber.

Heated casein containing about 45 per cent water can be be made into fibers over a wide range of acidities. Fibers can be made over a pH range of 3.0 to 10.0, though a pH of 4.7 is the most advantageous since subsequent neutralization is not required. The flow properties of casein, however, are easily destroyed. A very small quantity of formaldehyde or quinone incorporated into casein and water before extrusion prevents fiber formation. Also, the flow property of casein is decreased by modification of the protein, such as acetylation, deamination, esterification, and related reactions.

[4] McMeekin and Warner, *Journal*, Am. Chemical Soc., Vol. 64, p. 2393 (1942).
[5] Kline, Martin, and Crouse, *Proceedings*, Am. Soc. Testing Mats., Vol. 40, p. 1273 (1940).
[6] Lloyd and Phillips, *Transactions*, Faraday Soc., Vol. 29, p. 132 (1933).

Abstract of Paper on

Preparation, Properties, and Polymerization of Acrylic Esters[1]

Although some historical features and general developments in the field of acrylic esters and acrylic resins were given attention, the talk was primarily concerned with results obtained in an investigation of acrylic esters and acrylic resins. The work of the Carbohydrate Division of the Eastern Regional Research Laboratory in the acrylic field has consisted for the most part of studies on (1) the conversion of lactic acid into methyl acrylate and other acrylic esters by pyrolysis methods, (2) the preparation of the higher acrylic esters by alcoholysis of methyl acrylate, (3) the relation between structure of the monomeric acrylic ester and the properties of the corresponding polymer or resin, (4) the preparation by emulsion polymerization of aqueous dispersions of acrylic resins that can be used advantageously to coat paper, wood, glass, concrete, and similar materials, and (5) the copolymerization of acrylic esters with various comonomers for the purpose of preparing hard or flexible copolymers or resins having certain special properties.

Acrylic acid ($CH_2{:}CHCOOH$), the parent member of the acrylic family, was discovered in 1843 by Redtenbacher. Since this discovery, many acrylic acid derivatives have been prepared and converted into resins by polymerization. Beginning with 1927, some of the acrylic esters and their polymers attained commercial importance. The two most important acrylic esters at present are methyl acrylate and ethyl acrylate. The conversion of acrylic esters into acrylic resins by polymerization is effected by warming the monomeric ester in the presence of a small amount of catalyst, such as benzoyl peroxide. During the polymerization process, the acrylic ester molecules unite with each other to form long chain-like molecules, each of which usually contains 350 to several thousand acrylic ester units. The monomeric esters are colorless liquids of low molecular weight, whereas the polymers are colorless, transparent resins of high molecular weight.

Acrylonitrile ($CH_2{:}CHCN$), another derivative of acrylic acid, is of importance because it is used in the manufacture of some types of oil-resistant synthetic rubber. Several esters of alpha-methylacrylic acid ($CH_2{:}C(CH_3)$-$COOH$) are also manufactured in large quantities and used to make valuable products such as airplane windows and bomber noses and turrets. The polymers of alpha-methylacrylic esters are ordinarily harder than the corresponding polymerized acrylic esters. This is illustrated by the following softening temperatures of corresponding acrylic and alpha-methylacrylic resins.

TABLE I.—SOFTENING TEMPERATURES OF POLYMERIZED ESTERS.

Polymerized Ester	Softening Temperature, deg. Cent.	
	Acrylate	Methacrylate
Methyl..........	8	125
Ethyl...........	−20	65
n-Propyl.........	..	38
n-Butyl..........	−40	33
n-Octyl..........	..	Below room temperature

Difficulties experienced in developing an economical method for manufacturing acrylic esters were largely responsible for the long delay between discovery of the acrylic resins and commercial exploitation. Since about 1927, methylacrylate and ethyl acrylate have been manufactured from ethylene cyanohydrin. The cyanoydrin method, which requires ethylene (from petroleum) as a raw material, appears less suitable for preparing the higher acrylic esters.

Since Burns, Jones, and Ritchie's discovery in 1935 that methylacrylate is obtained by pyrolizing the acetyl derivative of methyl lactate, great interest has been shown in preparing acrylic esters from lactic acid by this method. A method, which has been studied on a pilot-plant scale at the Eastern Regional Research Laboratory, for converting lactic acid into methylacrylate is set forth below:

$$\text{Carbohydrates} \xrightarrow{\text{(Fermentation)}} \underset{\text{(Lactic acid)}}{HOCH(CH_3)COOH}$$

$$\text{Lactic acid} + \text{methanol} \longrightarrow \underset{\text{(Methyl lactate)}}{HOCH(CH_3)COOCH_3}$$

$$\text{Methyl lactate} + \underset{\text{or ketene}}{\text{acetic anhydride}} \longrightarrow \underset{\text{(Methylacetyl lactate)}}{CH_3COOCH(CH_3)COOCH_3}$$

$$\text{Methylacetyl lactate} \xrightarrow[\text{about 550 C.}]{\text{Pyrolysis at}} \underset{\text{(Methylacrylate)}}{CH_2{:}CHCOOCH_3} + \text{Acetic Acid}$$

Continuous and efficient methods have been developed for the last three steps. An important advantage of the lactic acid method of making methylacrylate is that carbohydrates, the raw material, are available in tremendous quantities at low cost. Moreover, carbohydrates, unlike petroleum and coal, are annually reproducible. Although the limitations have not been completely established, the following data (Table II) on yields of acrylic esters obtainable by pyrolyzing the corresponding acetylated lactic esters have been obtained.

TABLE II.—PRODUCTION OF ACRYLIC ESTERS BY PYROLYSIS OF ACETYL DERIVATIVES OF THE CORRESPONDING LACTIC ESTERS

Acetyl Derivative	Acrylic Ester ($CH_2{:}CHCOOR$)	Yield, per cent[a]
Methyl lactate..................	Methyl	90
Benzyl lactate..................	Benzyl	74
Tetrahydrofurfuryl lactate........	Tetrahydrofurfuryl	70 to 79
Phenyl lactate..................	Phenyl	80
o-Tolyl lactate..................	*o*-Tolyl	75
n-Butyl lactate..................	*n*-Butyl	15 to 24
Allyl lactate..................	Allyl	43
Methallyl lactate..................	Methallyl	41
beta-Methoxyethyl lactate........	beta-Methoxyethyl	31
beta-Ethoxyethyl lactate..........	beta-Ethoxyethyl	37

[a] Yield as percentage of the theoretical based on the acetyl lactic ester destroyed by the pyrolysis.

[1] Presented by Dr. C. H. Fisher, Eastern Regional Research Laboratory, Philadelphia, Pa., at a meeting sponsored by the A.S.T.M. Philadelphia District Committee, Franklin Institute, September 23, 1943. This laboratory is part of the Agricultural Research Administration, Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture.

The data in Table II show that the lactic acid method of preparing acrylic esters is satisfactory in some instances but clearly unsuitable for making some of the higher acrylic esters, such as *n*-butyl acrylate. In view of this limitation of the lactic acid method, the conversion of methylacrylate into other acrylic esters was studied. It was found that many of the higher acrylic esters, including those made from ethyl, *n*-propyl, *n*-butyl and iso-butyl alcohol, can be prepared in high yields by alcoholysis of methylacrylate. This method has been used conveniently in the Eastern Regional Research Laboratory to prepare many of the higher acrylic esters, which were then polymerized as water emulsions under standard conditions. The polymers thus prepared were examined to determine the effect of monomer structure upon the properties of the polymers. Some of the polymers (including phenyl and *o*-tolyl acrylate) were hard, whereas others were soft and flexible or even tacky. The properties of the polymeric *n*-alkyl acrylates varied in a regular manner with the length of the alkyl group. At ordinary temperatures polymerized methylacrylate is tough, pliable, and elastic enough to be stretched 1000 per cent before it breaks. Polyethyl acrylate, the next higher member of the *n*-alkyl acrylates, is softer and more elastic than the methyl ester but not quite so tough. In general, the softness of the polymers increases regularly as the length of the *n*-alkyl group increases.

Isomeric variations within the alcohol group have a marked influence upon the characteristics of the polymer. The polymer of isobutyl acrylate is noticeably harder and tougher than that of the *n*-butyl ester, being similar in its physical properties to the *n*-propyl acrylate polymer. The secondary butyl acrylate polymer is still harder, approaching the properties of the methyl ester in this respect. Although the polymeric *n*-butyl, isobutyl, and secondary-butyl acrylates vary in their degree of softness, all of them are elastic and pliable. In the tertiary-butyl acrylate the polymer has lost virtually all its pliability and is a hard, tough solid, almost brittle at ordinary temperatures. The tertiary-butyl acrylate polymer seems to be the hardest of all the aliphatic acrylate polymers. The relationship between the various isomeric polyamyl acrylates is the same as that of the butyl esters, except that the corresponding polymer in each instance is slightly softer.

The presence of a ring in the alcohol group decidedly increases the hardness of the polymer. The polymer of cyclohexyl acrylate is relatively hard and tough, whereas the *n*-hexyl ester is soft and tacky. The polymers of phenyl acrylate and *o*-tolyl acrylate are hard at room temperature. The presence of chlorine appears to increase hardness, since the polymer of chloroethyl acrylate is somewhat harder than of ethyl acrylate. Polymers prepared from acrylic esters, such as allyl acrylate or ethylene diacrylate, having two or more polymerizable double bonds are infusible and insoluble by virtue of the cross-linkages formed between the long chain-like molecules.

The polymerization of acrylic esters in aqueous emulsions has several advantages, and the emulsions thus produced are useful for coating paper, cloth, glass, concrete, and other materials. The acrylic resin emulsions resemble the latex of natural rubber and can be used as substitutes for rubber latex for some purposes. Some of the acrylic resin emulsions are stable enough to be applied by brushing, dipping, or spraying.

The copolymerization of acrylic esters with various comonomers for the purpose of preparing modified acrylic resins was discussed briefly.

Discussion of Paper on a Method of Interpolation[1]

Submitted by R. W. Coltman:[2]

Mr. Fry has given a method of calculating intermediate values between equidistant points on a cubic curve without the necessity of setting up the equation of the curve itself. In reading over this interesting article, it occurred to me that the formation of the new differences necessary for this purpose can be found in a somewhat simpler manner than by the procedure the author has outlined. At the same time, the subdivision can be extended to include the general case and not be restricted to one-fifth of the main interval. The procedure rests on the following proposition:

If A, B, and C are the first, second, and third differences of the polynominal $ax^3 + bx^2 + cx + d$ for the value $x_1 - x_0 = x_2 - x_1 = \Delta x$, then the first, second, and third differences A_1, B_1 and C_1 for the interval $\frac{\Delta x}{h}$ will be

$$\left.\begin{aligned} A_1 &= \frac{A}{h} + B\left(\frac{1-h}{2h^2}\right) + C\,\frac{(1-h)(1-2h)}{6h^3} \\ B_1 &= \frac{B}{h^2} + C\left(\frac{1-h}{h^3}\right) \\ C_1 &= \frac{C}{h^3} \end{aligned}\right\}\ldots\ldots(1)$$

If $h = 5$, as in the author's examples, then

$$\left.\begin{aligned} A_1 &= 0.2A - 0.08B + 0.048C \\ B_1 &= 0.04B - 0.032C \\ C_1 &= 0.008C \end{aligned}\right\}\ldots\ldots\ldots\ldots(2)$$

This equation will then replace Eq. 2 on p. 29 of Mr. Fry's paper. To apply them, we take the author's first example, and set up the difference tabulation as follows:

[1] Lawford H. Fry, "A Method of Interpolation," ASTM Bulletin, No. 122, May, 1943, p. 29.

[2] Lakewood, Ohio.

x	y			
0	10			
		20		
5	30		−10	
		10		30
10	40		20	
		30		
15	70			

which give

$$A = 20$$
$$B = -10$$
$$C = 30$$

These values substituted in Eq. 2 above give

$$\left.\begin{array}{l} A_1 = 4 + 0.8 + 1.44 = 6.24 \\ B_1 = -0.4 - 0.96 = -1.36 \\ C_1 = 0.24 \end{array}\right\} \ldots\ldots\ldots\ldots (3)$$

which are used in the method the author has outlined.

We can naturally also set up the differences for the subdivision of the large intervals into any smaller fraction by substituting the proper value of b in Eq. 1.

I would also call your attention to some misprints in the "General Expression for Position n in Series" at the bottom of p. 29, column 1. In order to give the values in terms of a, b, and c that the author has set up, I believe the formula for "First Difference" should read:

$$\Delta_1 = a + (n - 1)\, b + \frac{(n - 1)(n - 2)}{2} c$$

Substitution of 10 for n will give

$\Delta_1 = a + 9b + \frac{9.8}{2}c = a + 9b + 36c$, in accordance with the table,

while by substitution in the formula given in the article we obtain

$$a + 9b + \frac{10 - 9c}{2} = a + 9b + \frac{c}{2},$$

obviously wrong.

A similar error, as well as one of sign, occurs in the expression representing the number. This should read:

$$\text{Number} = N_0 + na + \frac{n(n - 1)}{1.2} b + \frac{n(n - 1)(n - 2)}{1.2.3} c$$

Substituting 10 for n, for example, gives

$N_0 + 10a + 45b + 120c$, in accordance with the table.

Submitted by J. F. Purdy:[3]

On p. 29, first column of Mr. Fry's paper are the equations:

$$\text{First Difference} = a + (n - 1)b + \frac{n - (n - 1)}{2} c$$

$$\text{Number} = N_0 + na + \frac{n - (n - 1)}{1 \times 2} b - \frac{n(n - 1)(n - 2)}{1 \times 2 \times 3} c$$

[3] Development Dept., The Goodyear Tire and Rubber Co., Akron, Ohio.

Did the author intend to write them as:

$$\text{First Difference} = a + (n - 1)b + \frac{(n - 1)(n - 2)}{2} c$$

$$\text{Number} = N_0 + na + \frac{n(n - 1)}{1 \times 2} b + \frac{n(n - 1)(n - 2)}{1 \times 2 \times 3} c$$

The latter forms are correct, and agree with the data of his Tables I and II.

Submitted by Deane B. Judd:[4]

This paper is a good example of the use of power series to represent engineering results, and the author should be commended for bringing it to the attention of readers of the ASTM BULLETIN. However, the formula derived forms the first three terms of Newton's interpolation formula to be found in many previously published treatments of interpolation. For example, Mellor[5] gives this formula, together with a reference to Newton's *Principia*, *3*, lem. 5, 1687.

He also gives the Lagrange interpolation formula (p. 310) for n values that need not be equidistant, as in Newton's formula.

Incidentally, there is a typographical error in the third term of the formula which should read: $bn(n - 1)/2$; the first minus sign appearing in the published version should be deleted and a similar correction should be made in the third term of the expression for the first difference.

The method of computing interpolated values as in Table II by continuous addition of the minor differences is a very good one, and has been used extensively by actuaries and, no doubt, in other fields, for example, J. Karup.[6]

Perhaps the author may wish to prepare a supplement which would acquaint readers of the ASTM BULLETIN with the powerful general methods that are already available rather than be content with this special case, however useful it may be. I have found Glover's paper[7] to be particularly valuable.

Closure by Mr. Lawford H. Fry:[8]

The author was very much interested by Mr. Judd's historical comments. He had not realized that he was venturing along a path already worn smooth by such illustrious feet as those of Newton and his followers. He regrets he could not add a bibliography as Mr. Judd suggested. The author had read nothing on the subject, but happening to want a method of interpolation had worked out that given in the BULLETIN.

The author is indebted to Messrs. Judd, Purdy, and Coltman for pointing out typographical errors. Mr. Coltman suggested interesting simplifications and extensions of the method.

[4] Physicist, U. S. Department of Commerce, National Bureau of Standards, Washington, D. C.

[5] Mellor, "Higher Mathematics for Students of Chemistry and Physics," p. 309, Longmans, Green & Co., London (1905).

[6] J. Karup, "A New Mechanical Method of Graduation, *Transactions*, Second International Actuarial Congress, p. 83 (1898).

[7] Glover, "Derivation of the United States Mortality Table by Osculatory Interpolation," *Quarterly Publication*, Am. Statistical Assn., Vol. 12, No. 87 (1910).

[8] Director of Research, The Locomotive Institute, New York, N. Y.

Synthetic Detergents as Hard Water Soaps in the War Effort[1]

By Conrad J. Sunde[2]

Synthetic detergents, as we know them today, have played an important part in the war effort and will continue to play an increasingly greater part before the war is over. The first of the newer synthetic detergents to be introduced to the American market, according to Flett,[3] was one of the gardinols manufactured in Europe. This took place about the year 1930. In the gardinols, we have fatty alcohol sulfates R—OSO_3Na, where the group R usually has 12 to 16 carbon atoms. Here we have an ester of the alcohol with sulfuric acid. These gardinols were a mixture of sulfate and perhaps some sulfonates made from alcohols derived from coconut oil. Mullin[4] has given a very interesting discussion of this type of synthetic detergent in a series of articles which he started publishing in 1937.

During the past decade, a number of other types have been introduced commercially, such as:

(1) R—$COOC_2H_4$—SO_3Na. The group R again usually has from 12 to 16 carbon atoms. Here the solubilizing group is the sulfonate group and this molecule has an ester linkage.

(2) R—$COOCH_2CHOHCH_2$—OSO_3Na. Here again we have an ester group as the linking group and the sulfate as the solubilizing group.

(3) R—CONH—C_2H_4—SO_3Na. In this type we have the fatty acid amide group as the linking group and the sulfonate or sulfate as the solubilizing group.

(4) R_x—Ar—SO_3Na, the alkylarylsulfonates. Here with one group R, the group has from 12 to 16 carbon atoms tied to an aromatic ring and the sulfonate group is the solubilizing group. When more than one aliphatic group is present, each alkyl group may be considerably shorter.

It was not until we had gained some understanding of the functions of the different parts of the soap molecule that the possibilities of the synthetic detergents were appreciated. In soap, we have the sodium or potassium salt of a higher fatty acid. The acid part may be saturated or unsaturated, and the length of the carbon chain varies from 12 carbon atoms in lauric acid to 18 in stearic acid. However, regardless of the length of the carbon chain, we have a molecule R—COOM, in which we have a hydrophobic and a hydrophylic part, or an oil-soluble and a water-soluble part. The length of the carbon chain has a marked influence on the solubilizing effect of the carboxyl group. This is more marked in the case of ordinary soaps than in the case of synthetic detergents, since the solubilizing effect of the carboxyl group is less than the solubilizing effect of the sulfate or the sulfonate groups.

As we consider the salts of a homologous series of straight chain fatty acids, we find a change in properties as we go up the series, and only a few members of the series give useful cleaning agents. We find a similar change in properties as we consider a homologous series in the synthetic detergent field. Thus, according to Mullin,[5] the solubilities of the calcium and magnesium cetyl and stearyl sulfates are very similar, but that of the corresponding myristyl compound is at least six or eight times as great, while calcium lauryl sulfate is about ten times as soluble as the myristyl compound. Calcium decyl sulfate is about 100 times as soluble as the lauryl salt.

Salt-water soaps in the past have been made from high lauric acid oils, particularly coconut oil. After Allied reversals in the Far East, our supply of suitable oils was sharply curtailed. This gave added impetus to the development of new types of soaps containing synthetic detergents. The extent to which industry was forced to curtail its use of coconut oil in soapmaking can be judged from a preliminary report by the Bureau of Census.[6] The American soap industry used 484,124,000 lb. of coconut oil in 1941, while in 1942 they used only 140,487,000 lb. These figures are perhaps more impressive when we consider that the industry used approximately 100,000,000 lb. during the first half of 1942, and only 40,000,000 lb. during the last half. At the same time, industry was faced with a curtailment of the supply of palm oil, palm kernel oil, and olive oil foots. The shortage of high lauric acid oils affected not only the manufacture of salt-water soaps, but also the manufacture of several types of synthetic detergents and, in particular, that of the higher alcohol sulfates. This has thrown an increasing burden on those synthetic detergents for which raw materials are still available.

The Armed Services, foreseeing the possible oil shortage, gave early consideration to the use of synthetic detergents as a possible substitute for coconut oil soaps. For example, T. A. Werkinthin[7] of the Standards and Tests Section of the Bureau of Ships, Navy Department, Washington, D. C., started investigating synthetic detergents as early as 1938. This work was carried on in connection with the industry. The main stumbling block in developing a synthetic detergent in bar form which would act and look like soap to the average enlisted man was the development of a suitable binding agent and diluent. Various materials, such as thiourea, urea, etc., were tried. The main difficulty was crumbling of the bar after use and a

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[1] Paper presented at a meeting of Committee D-12 on Soaps and Other Detergents, of the American Society for Testing Materials, June 8, 1943, New York, N. Y.

[2] Consultant, Chemical Materials Section, Materials Branch, Conservation Division, War Production Board, Washington, D. C.

[3] Laurence Flett, "Detergents from Petroleum," *Chemical and Engineering News*, Vol. 20, No. 13, pp. 844–848 (1942).

[4] Charles E. Mullen, "The Newer Detergents," *Soap and Sanitary Chemicals*, Vol. 13, No. 11, pp. 30–33, 74 (1937); Vol. 13, No. 12, pp. 27–30, 73–74 (1937); Vol. 14, No. 1, pp. 30–33, 74 (1938); "Synthetic Detergents," Vol. 14, No. 2, pp. 32–35, 73–74 (1938); Vol. 14, No. 3, pp. 30–33 (1938); Vol. 14, No. 4, pp. 32–33, 73–74 (1938).

[5] Charles E. Mullen, "The Newer Detergents," *Soap and Sanitary Chemicals*, Vol. 13, No. 12, 27–30, 73–74 (1937).

[6] Anonymous, "1942, Soap, Fat and Oil Use," *Blue Book for Manufacturers and Distributors of Soap and Sanitary Chemicals*, pp. 145 and 146 (1943).

[7] Private communication.

tendency to be deliquescent. The incrustations rendered the surface of the bar abrasive. It was not until someone of the industry suggested that ordinary soap might, contrary to accepted theories, serve the purpose, that this problem was solved. This has the additional advantage that existing soapmaking equipment can be used.

As the work progressed, the personnel of the Standards and Tests Section of the Bureau of Ships realized more and more that eventually a shortage of suitable oils would develop and that synthetic detergents would become a necessity for Navy use.

According to Ruckman, Hughes, and Clarke[8] the Naval Engineering Experimental Station, Annapolis, developed a formula which uses three washes in salt water, two rinses in sea water, and a final rinse in fresh water. Some of the detergents tested gave results for salt-water washing equal to the results obtained with a conventional soap formula using soap and alkali in soft water. This development makes possible a considerable saving of fresh water aboard ships.

In the study by the Bureau of Ships,[8] on the relative cleaning efficiencies of solutions of detergents in synthetic sea water for the removal of soil from painted surfaces, a considerable number of cleaning compounds were included. The common types of synthetic detergents, alkalies, mixtures of synthetic detergents and alkalies, soap, mixtures of soaps and synthetic detergents, and mixtures of soap and abrasives were tested. One of the synthetic detergents tested approximates the cleaning efficiency of the bar form of salt-water detergent manufactured in accordance with the Bureau of Ships Ad Interim Specification 51-D-7 (INT).

For general use by all personnel, there is more waste due to taking excessive amounts with a powdered detergent than with a bar detergent. Hence, the bar detergent was developed for general purposes, and its development came at an opportune time. The Navy, in March, 1942, received bids on only one fourth of the quantity of coconut oil soap they asked for, but their bar detergent was now ready to take over. The Bureau of Ships Specification, Detergent; Salt-Water, Bar Form, was issued on April 15, 1942; and on July 3, 1942, the first bids on this type of detergent were opened. Since that time, the Navy has purchased or has placed contracts for 32,000,000 lb. of this type of detergent.

In like manner, the Office of the Quartermaster General[9] of the Army, even before Pearl Harbor, recognizing that they might be faced with a global war, started investigating possible detergents for use in the Mobile Laundry Unit. These investigations showed that synthetic detergents had advantages over the usual laundry cleaning agents for this purpose. In addition, due to the scarcity of the ordinary hard-water soap materials, and because the older products do not possess the functional properties required in the Army today, a new product has been developed. This product contains, among other things, some synthetic detergents or mixtures of synthetic detergents. Functional requirements include toilet uses, shaving, laundering of clothes, cleaning mess kits and similar equipment in waters ranging from zero degrees hardness to a hardness equivalent to that of sea water at temperatures from near freezing to 100 F.

[8] N. E. Ruckman, Ray Hughes, and F. E. Clarke, "Salt Water Detergents," *Soap and Sanitary Chemicals*, Vol. 19, No. 1, pp. 21–23 (1943).

[9] Private communication.

Because of the global nature of the war, all kinds of water are encountered for laundry and other washing operations. The use of sea water and water that may be even worse has become a "must" with a resulting requirement for increasing amounts of synthetic detergents. Since the raw materials are restricted for those detergents whose manufacture depends on various oils, an increasing part of the burden is falling on those made from noncritical materials or less critical materials. The ever-changing raw material situation has necessitated definite modifications in synthetic detergents, both from the standpoint of manufacture and use. For the manufacture of the alkylarylsulfonates, an aromatic compound is usually required which is also a critical chemical.

With requirements of the Armed Services for synthetic detergents increasing, and a limited production capacity available, it would seem that any considerable civilian use of these products does not appear possible in the near future. In addition, when considering the over-all fats and oil situation, the Department of Agriculture maintains, and rightly so, that food uses come first. Hence, a series of orders have been issued limiting the uses, in particular, of vegetable oils. Materials used for making soap are under the restrictions of the following orders of the War Food Administration:

FDO-42—Restrictions on Use of Fats and Oils.—This order prohibits the use of certain fats and oils for making soap and restricts the amount of fats or oils that can be used for making soap for civilian consumption.

FDO-33—Required Recovery of Glycerin.—This order limits the amount of glycerin that may be left in soap and sets up standards for glycerin recovery.

FDO-34—Restrictions on Use, Processing, and Delivery of Glycerin.—This order places glycerin under complete allocation with the usual small-order exemption.

FDO-38—Restrictions on Use, Consumption, Processing, Sale, and Delivery of Palm Oil.—This order restricts the use of palm oil to certain specific uses including processes where glycerin is produced.

FDO-43—Restrictions on Use, Processing, Sale, and Delivery of Coconut, Babassu, Palm Kernel, and Other High-Lauric Oils.—This order limits the use of high lauric acid oils to processes in which glycerin is produced with certain oils exempted for food uses.

FDO-53.—Places red oil, lard oil, and meat's-foot oil under complete allocation.

Also Lend-Lease requirements are increasing, and even linseed oil is being shipped for food purposes. During the month of April, approximately 36,000,000 lb. of edible linseed oil went to Lend Lease and related purposes. Shipping space for food has a priority on a par with planes and trucks.

Synthetic detergents are controlled through allocations of the raw materials used in their manufacture. If the fats and oils situation continues to become more critical, the time may well arise when it will be necessary to allocate critical chemicals for the manufacture of synthetic detergents for the most essential civilian uses.

The statement made by our friend, W. H. Gardner, with reference to linseed oil and its possible use in food that "You can't have your paint and eat it" applies equally well to soap. You can't eat your soap and have it too.

Studies on Synthetic Detergents*

By Jay C. Harris[1]

THE INABILITY of the U. S. Navy Department in March, 1942,[2] to obtain a sufficient number of bids to cover requirements of salt water soap was probably the fact which focused attention on synthetic detergents for salt water usage. The Federal specification P-S-611 for this soap[3] required the use of coconut or palm kernel oils which no longer were available in the quantity required. The Army had early been forced to use synthetic detergents in their mobile laundry units because of the water conditions which might be encountered. Another reason for their choice of a synthetic agent in preference to others was the relatively short washing cycle which is observed and the necessity for using a material which would not cause dermatitis if not fully rinsed from wearing apparel.

Studies on Synthetic Detergents

With the exception of a paper by Ruckman, Hughes, and Clarke[2] there have been no recent publications covering sea water detergents, nor is there information showing the effect of extremely hard water upon the detersive effect of certain widely used synthetic agents. These investigators described sea water detergency tests with a synthetic detergent-soap combination at 2, 4, and 6 per cent in which excellent results were obtained. This combination is covered by Bureau of Ships ad Interim Specification 51-D-7 (INT) and requires minimum amounts of 30 per cent anhydrous, salt-free soda soap and 20 per cent anhydrous, salt-free synthetic detergent. This product is shown by these investigators to be approximately three times as effective as the formerly used salt water soap at 2 per cent concentration, $2^1/_2$ times at 4 per cent concentration, and no essential difference at 6 per cent concentration. Their results indicate that use of this type product should yield improved, lower cost cleansing, since smaller quantities of detergent are required. The product has improved solubility, and also possesses greater rinsability. Either of these improvements individually might warrant the merchandising of such a product by manufacturers.

Aside from the general-purpose bar soap described in Bureau of Ships Specification 51-D-7, which was designed for cleansing by hand, there is need for power-laundry detergents useful in sea water. In general, an anhydrous soap-containing composition is rather difficult to dissolve in sea water, and this probably would tend to eliminate the 51-D-7 type material in relatively anhydrous powder or flake form for use in power washing operations, especially dry to the wheel. Furthermore, a suitable composition containing no soap would probably be more economical, and there would be less tendency to insoluble curd formation. Wherever an adequate water supply is available and time requirements are not too pressing, more satisfactory cleansing, especially of heavily soiled garments, could be attained by combining a suitable alkali with the synthetic detergent.

Aside from the development by the Bureau of Ships of a detergent for power-laundry use, the Army is developing an all-purpose toilet cake. This product will require considerable amounts of a synthetic agent to make its performance acceptable. Other specifications which mention the use of synthetic detergents are:

Compound, Cleaning; For Painted Surfaces; Bureau of Ships ad Interim Specification 51-C-20 (INT); March 15, 1941.

Compound, Cleaning; For Painted Surfaces; Proposed Federal Specification; June 9, 1942.

One or two other specifications mention the use of synthetic detergents but for reasons of national defense these cannot be abstracted either in whole or in part. Once these combinations of materials have been "battle tested," it is likely that they will find continued and expanded usage in civilian life, once conflict has ended.

There is no published comparative detergent data made under extremely hard water, or sea water conditions with synthetic detergents, combinations of synthetic detergents with soap, or with alkaline builders. A definite need for such data exists if the most suitable materials are to be used effectively and economically. Our several objects in performing these experiments were:

1. The determination of the effect of extremely hard water upon one type of synthetic agent.
2. The determination of the optimum amount of detergent to produce adequate cleansing results in extremely hard water.
3. The evaluation of combinations of synthetic detergent and certain builders in extreme hardnesses.
4. The development of data for synthetic sea water cleansing and the determination of the optimum concentration range for synthetic detergent and 51-D-7 salt water detergent.
5. The preparation of data to demonstrate the most effective combinations of soap and synthetic detergent, and synthetic detergent and alkaline builders.

It is obvious that a program of this type could have been lengthened extensively unless certain limits were arbitrarily set. We, therefore, confined our investigation to one synthetic detergent in several forms of varying active ingredient content; to extreme conditions of hard water usage; to synthetic sea water; to certain alkalies which have been proved effective in hard water and to concentrations of detergent which provided adequate soil removal. Extension of the program could be made to include other synthetic agents, other alkalies, and varying percentages of the combinations, finally supplemented by power-wash wheel tests under the conditions of usage.

The data provided by our experiments should prove of

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* Paper presented at a meeting of Committee D-12 on Soaps and Other Detergents of the American Society for Testing Materials, June 8, 1943, New York, N. Y.

[1] Monsanto Chemical Co., Dayton, Ohio.

[2] H. E. Ruckman, Ray Hughes, and F. E. Clarke, "Salt Water Detergents," *Soap*, Vol. 19, No. 1, pp. 21–23 (1943).

[3] Federal Specification for Soap; Salt-Water P-S-611, October 14, 1930.

value to the armed forces and to the industry in the development work which they are doing on these synthetics, and synthetic and soap combinations.

Experimental Data

Materials Tested:

All materials were tested on the anhydrous basis.
Santomerse No. 1—40 per cent active ingredient.
Santomerse No. 55—55 per cent active ingredient.
Santomerse No. 3—99+ per cent active ingredient.
Chip soap—titer 37.2. A widely used tallow—coconut soda soap.
Tallow kettle soap—titer 39.5. An all-tallow soda soap.
Tetrasodium pyrophosphate—technical, anhydrous.
Trisodium phosphate—technical, hydrated.
Sodium carbonate—c. p. grade.
Sodium acid pyrophosphate—technical grade.
51-D-7 Salt Water Detergent—*Laboratory grade*—Prepared with tallow kettle soap and Santomerse No. 55 according to 51-D-7 specifications. *Plant grade*—A sample which it is claimed meets the 51-D-7 requirements.

Synthetic Hard Water:

Hardness as parts per million $CaCO_3$ using calcium chloride and magnesium sulfate so that 60 per cent of the hardness is Ca and the balance Mg.

Synthetic Sea Water:

	Grams per Liter
Magnesium chloride ($MgCl_2 \cdot 6H_2O$)	22.0
Calcium chloride ($CaCl_2 \cdot 2H_2O$)	3.2
Sodium sulfate (Na_2SO_4)	8.0
Sodium chloride (NaCl)	50.0

Note.—This is double the concentration required by the 51-D-7 specification, but the detergent sample is first dissolved in distilled water, to twice the percentage concentration desired, cooled, then diluted with an equal volume of the sea water formula.

Test Conditions

Although the details of the wash test procedure are described in an earlier paper[4] it may be well to review them here:

Standard soil—Oildag 30 g.; Wesson oil 7.5 g.; Carbon tetrachloride 1800 ml.
Applicator—Mechanical, comprising a box containing the soil solution, wringer rolls and dryer tube.
Fabric—Indian Head, 54 × 46 thread count.
Fabric—Solution Ratio—1:29.
Number of replicate swatches—2.
Number of washes—4.
Duration of wash—10 min.
Volume of wash solution—100 ml., discarded after each wash.
Temperature of wash—140 ± 2 F.
Number of rinses—Two of water hardness in use.
Washing apparatus—Standard Launderometer.
Number of rubber balls used—10.
Speed of rotation of Launderometer—40 ± 2 rpm.
Lather—Estimated at second wash. Cannot be greater than 4 in.
pH values—Determined with wash solutions, using L & N glass electrode.
Photometer—Lange photoelectric.
All tests—Anhydrous basis.

The Lange photoelectric photometer was used to measure the degree of soil removal. White, unsoiled but desized Indian Head fabric was used as 100 per cent white (maximum whiteness attainable) and the standard soil used in the particular test was used as 0 per cent white or 100 per cent black. On this basis, soil removed during the washing operation was measurable as direct percentage soil removal.

[4] J. C. Harris, J. R. Eck, and W. W. Cobbs, "Detersive Efficiency of Tetrasodium Pyrophosphate—Part II," *Oil and Soap*, Vol. 19, No. 1, pp. 3-13 (1942).

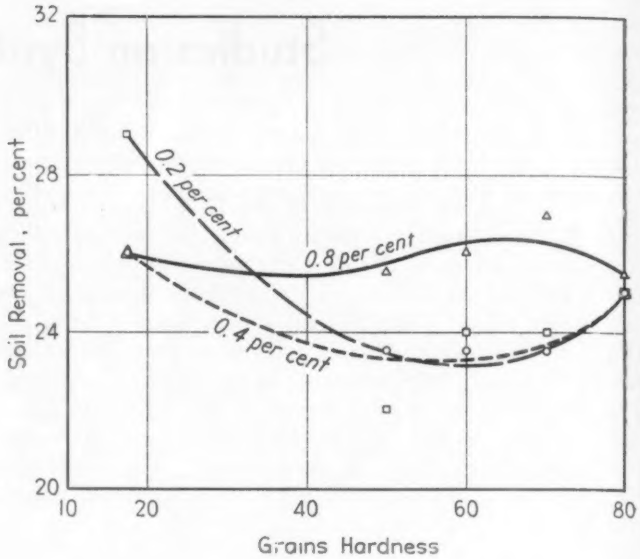


Fig. 1.

The method for reducing the test results to a single significant figure was as follows: The wash test results for each of the duplicate 10-min. washes were averaged, and an average calculated from these four. This corresponds to a percentage soil removal value based upon the following equation:

$$\text{Percentage soil removal} = \frac{a + b + c + d}{4}$$

All the curves were based upon the average of not less than two complete series of wash tests.

The foregoing data describe the "multiple suds" method of operation. A "single suds" method was employed for certain tests, the results of which are described later on. In this operation, the only variation from the usual test was to wash only once, for a 15-min. period, rinsing as usual in the water used for the test.

pH values were obtained with the Beckman equipment using a high pH glass electrode where pH values were 8 or

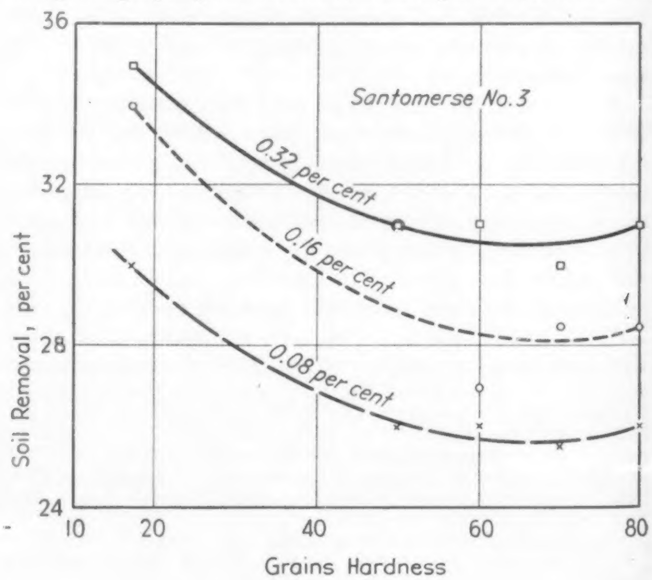


Fig. 2.

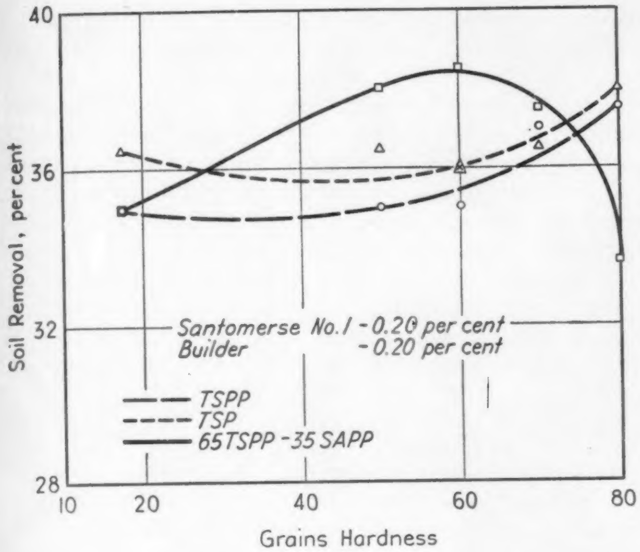


Fig. 3.

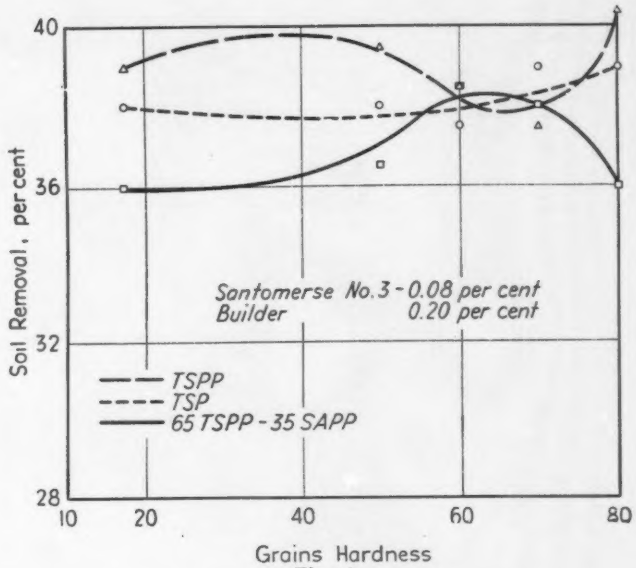


Fig. 4.

above. The wash solutions were tested at a temperature of 25 ± 2 C.

Discussion of Results

Hard Water Tests:

The first series of tests were made to determine the effect of extremely hard water upon varying concentrations of "Santomerse No. 1" and "Santomerse No. 3."[5] It will be noted in Fig. 1 that increasing water hardness with 0.2 per cent and 0.4 per cent concentrations of "Santomerse No. 1" tends to reduce cleansing efficiency, but that an 0.8 per cent concentration is practically unaffected by water hardness.

[5] Synthetic detergents made by Monsanto Chemical Co., St. Louis, Mo., and containing as the active ingredient what is essentially dodecylbenzene sodium sulfonate.

The results with "Santomerse No. 3" (Fig. 2) show that increasing water hardness reduces detersive efficiency, but that an 0.32 per cent concentration produces the highest degree of soil removal. It is interesting that an 0.8 per cent concentration of "Santomerse No. 1" contains 0.32 per cent active ingredient, and that the absence of sodium sulfate in this test apparently provides improved soil removal. In the course of considerable experimental work we have repeatedly proved that pH adjustment above neutrality, especially in the range of 9.5 to 10.5, will result in marked increases in soil removal, especially if the soil is of the difficultly removable type. The addition of TSPP, TSP, or a 65–35 mixture of TSPP-SAPP resulted in marked improvement in soil removal over "Santomerse" alone as is shown by comparison of Fig. 1 with Fig. 3. That this improvement is not confined to "Santomerse No. 1" is

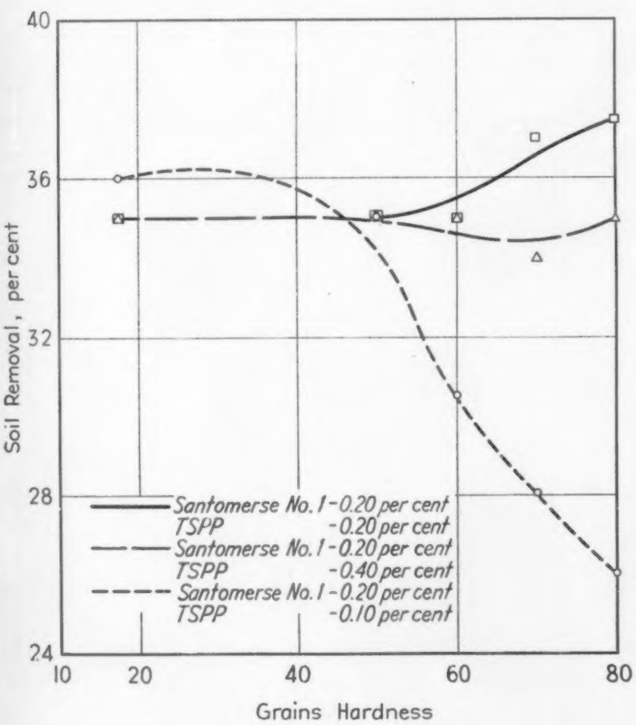


Fig. 5.

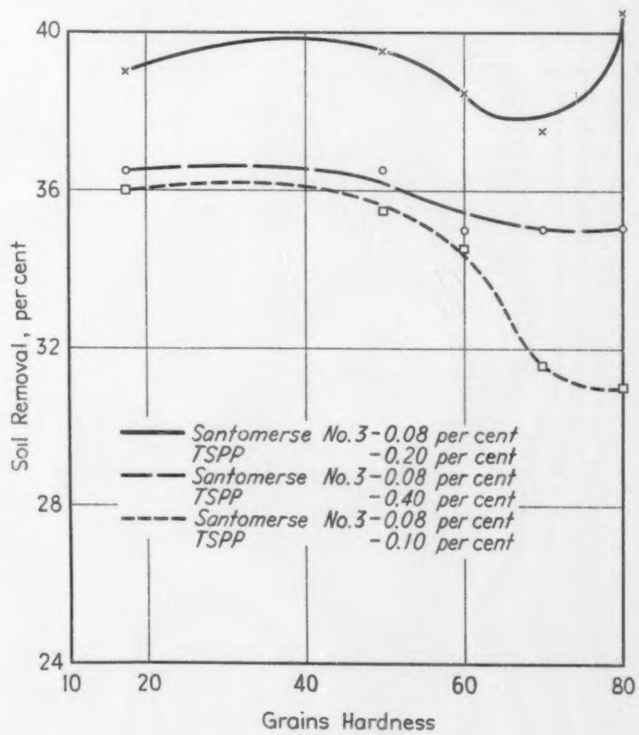


Fig. 6.

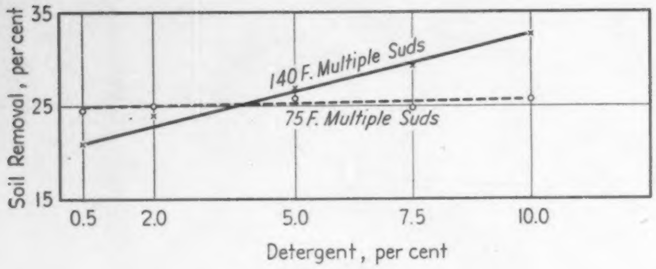


Fig. 7.

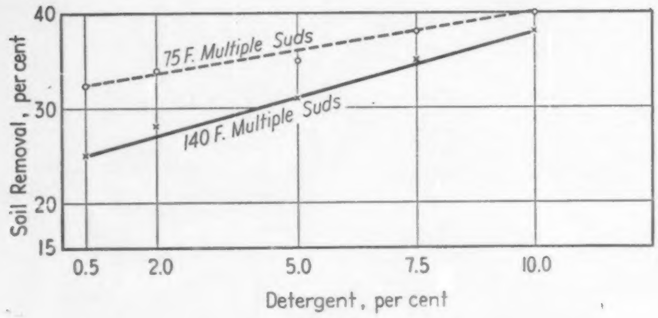


Fig. 8.

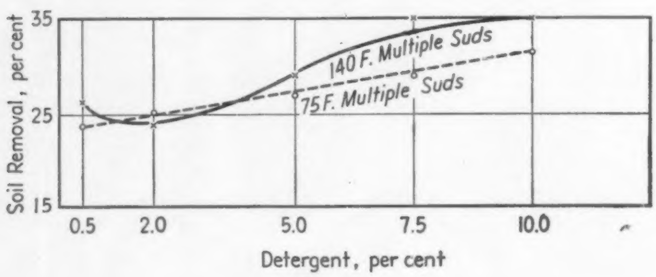


Fig. 9.

shown in Fig. 4, in which an active ingredient concentration of 0.08 per cent of "Santomerse No. 3" was tested in combination with the same alkaline builders. Slightly higher detergent results may be attributed to the absence of sodium sulfate, since the active ingredient concentration for either product is identical under the test conditions. In the next series of tests, the percentage of "Santomerse No. 1" was maintained at 0.2 per cent and the percentage of TSPP was varied to ascertain the optimum amount to maintain good detergency even though water hardness was increased to a high level. Reference to Fig. 5 shows that an 0.2 per cent concentration of TSPP produced the desired level of cleansing. The same type of test was made with "Santomerse No. 3" at 0.08 per cent concentration, varying the TSPP as with "Santomerse No. 1." Figure 6 shows that again an 0.2 per cent concentration of TSPP in combination with "Santomerse No. 3" resulted in the optimum degree of soil removal.

These tests conclusively show that wherever possible, that is, where there is an adequate supply of water, sufficient processing time so that alkali may be rinsed from the garments, or where a sour may be used, that TSPP or TSP combined with "Santomerse" will result in improved cleansing.

Sea Water Tests:

Since hard water reduces the detergent efficiency of "Santomerse" when insufficient amounts of the detergent are used, it was expected that sea water tests would corroborate these findings. This indeed was the case, though the effect was less noticeable because the tests were begun at an 0.5 per cent detergent concentration (see Figs. 7, 8, and 9).

"Santomerse No. 1" concentration has little effect upon detergency at 75 F., but slightly increased detergency results with greater concentration when tests are made at 140 F. Improved soil removal is obtained with "Santomerse No. 55" (Fig. 8) as compared with "Santomerse No. 1," and increased concentration results in increased soil removal. In all three cases, however, relatively poor detersive action is obtained, especially when the results are compared with those obtained with the 51-D-7 salt water detergent shown in Figs. 10 and 11. With the 51-D-7 product there is an almost 100 per cent greater soil removal than was obtained with the synthetic detergents alone, even though the active ingredient content of the synthetic agent is actually lowered, and soap is present, which alone is a relatively poor salt water detergent.

A comparison between a laboratory prepared sample of 51-D-7 detergent bar and one prepared commercially is shown in Fig. 11. There is considerable discrepancy between the two samples, best explained upon the basis of relative pH value.

Reference to Table I will show that the plant sample has a very low pH value compared with the laboratory sample,

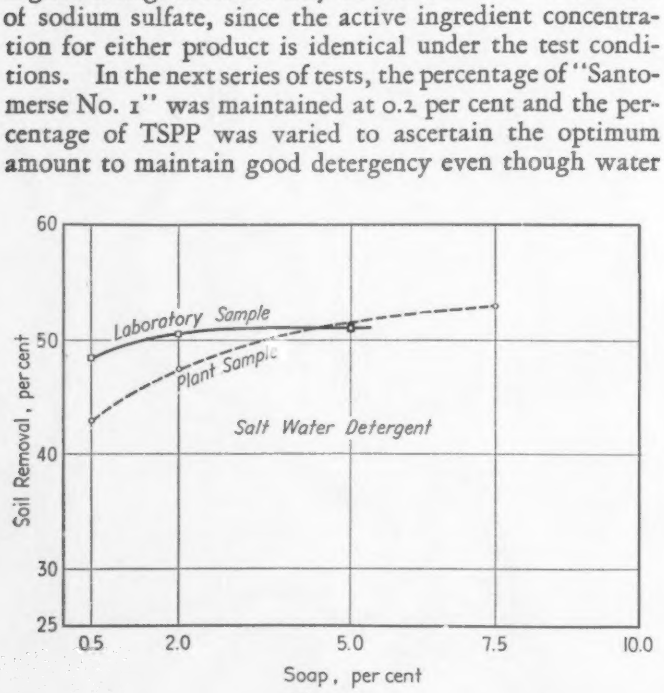


Fig. 10.

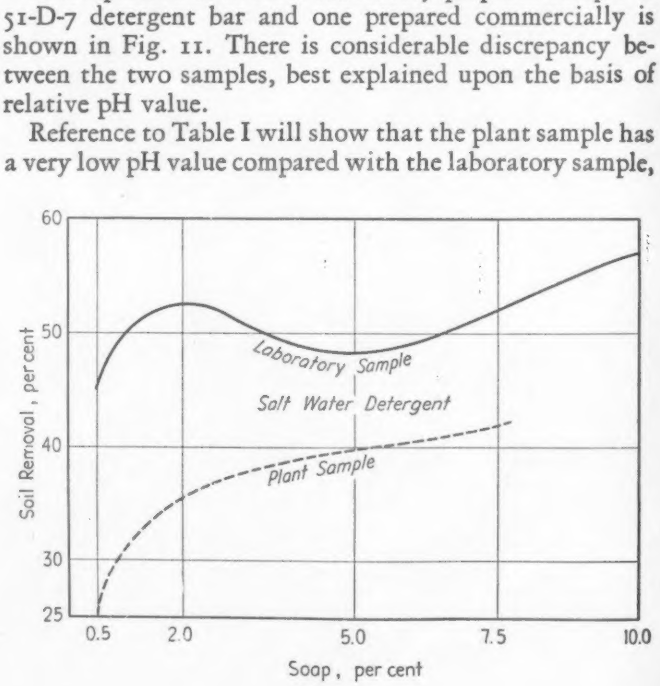


Fig. 11.

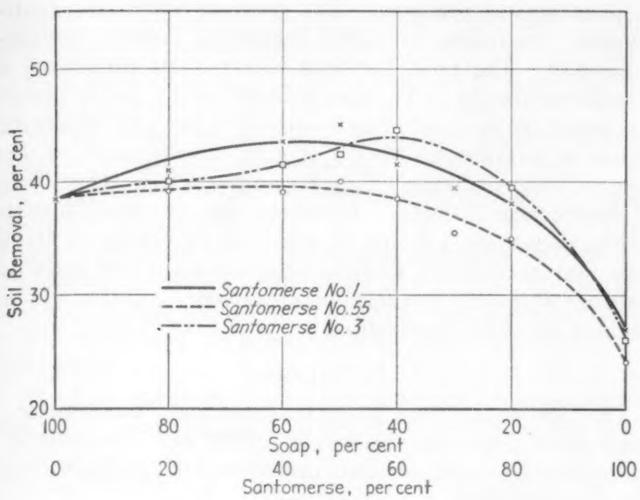


Fig. 12.

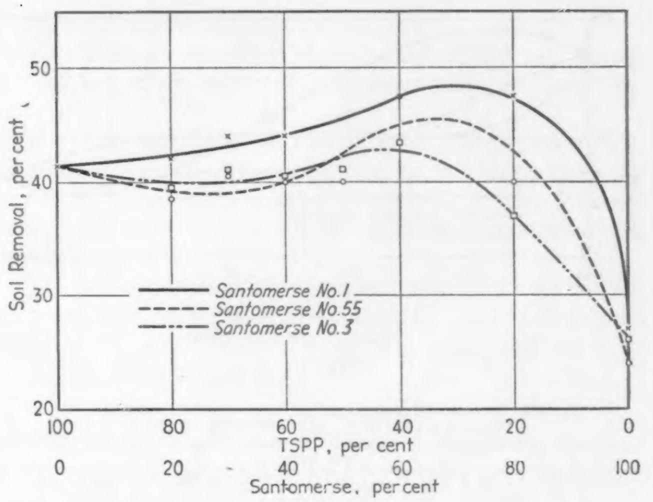


Fig. 13.

which explains the discrepancy upon the basis that optimum soil removal is obtainable when pH values are adjusted to a range approaching that of soap in distilled water. Just why there should be a dip in the laboratory sample curve at 5 per cent concentration is not known. However, regardless of this point, approximately a 2 per cent concentration of detergent, which is a reasonable percentage to work with so far as solubility is concerned, was chosen for further work. Reference to Figs. 10 and 11 shows that increases in soil removal attained beyond this point are not marked.

Ruckman, Hughes, and Clarke[2] showed that the 51-D-7 product possessed outstanding merit as a sea water detergent. However, no data have been published to show whether or not the ratio of active anhydrous soap to active synthetic detergent agent as specified is an optimum. Our next work, therefore, was the determination of this point.

There was no tallow kettle soap available when this work was begun, so we used that designated above as chip soap. Subsequent tests were made with tallow kettle soap to determine what effect this would have upon detergent results. The only effect would have been a lowering by 3.5 per cent of the soil removal where 100 per cent soap was used, with no practical effect upon the detergency of the soap-"Santomerse" combinations.

Figure 12 and Table II show the detergency results obtained with soap-"Santomerse" combinations. They show that regardless of the kind of "Santomerse" used, that is, whether containing 40 per cent, 55 per cent, or 100 per cent active ingredient, the three curves all fall within the limits of experimental error. An important fact is that the range for maximum soil removal lies between 60 per cent soap, 40 per cent "Santomerse," and 35 per cent soap, 65 per cent "Santomerse."

TABLE I.—SALT-WATER-DETERGENT LATHER AND pH DATA.
140 F. Multiple Suds Operation.

Sample	Concentration, per cent	pH	Suds, in.
Laboratory............	0.5	8.0	1/4
	2.0	8.6	1
	5.0	9.1	4
	7.5	10.2	[a]
	10.0	10.7	[a]
Plant................	0.5	6.9	1/4
	2.0	8.1	3 1/2
	5.0	8.6	4
	7.5	8.9	4

[a] Unable to determine, since a thick paste coated inside of jar.

It was believed that the soap present in this series of tests acted essentially as an alkali, and exerted little detergent effect. Examination of Fig. 12 will show that soap produces a relatively high percentage soil removal. It is recognized, however, that soap alone, especially when dry, is almost impossible to get into sea water solution, and that degree of solubility is low, hence that the unusually high detergent effect must be attributed to the combination of soap and synthetic. Therefore, it should be possible to obtain almost exactly the same results by substituting an alkali for the soap. This test was made as shown in Fig. 13 and Table III. It will be noted that the pH value for the TSPP-"Santomerse" combinations rapidly drop to points lower than for soap-"Santomerse" mixtures. However, the peak for TSPP is higher than for soap and has shifted toward the point of increased ratio of "Santomerse" to TSPP. Having proved the point that an alkali could be used in place of soap to obtain good sea water detergency it was thought that a mixture of alkali and soap combined with "Santomerse" might be an improve-

TABLE II.—SOAP-SANTOMERSE COMBINATIONS. SEA WATER TEST.
2 per cent Concentration Detergent.

Combination	Santomerse No. 1		Santomerse No. 55		Santomerse No. 3	
	Suds, in.	pH	Suds, in.	pH	Suds, in.	pH
Soap 100%......	Trace	7.9	..	...	...	...
Soap 80%, Santomerse 20%.....	1/4	8.0	1/2	8.1	1	8.3
Soap 60%, Santomerse 40%.....	1 1/2	8.3	2	8.2	4	8.4
Soap 40%, Santomerse 60%.....	3 1/2	8.3	4	8.2	4	8.2
Soap 20%, Santomerse 80%.....	4	8.0	4	7.8	4	7.8
Santomerse 100%......	4	8.0	4	7.0	4	6.9

TABLE III.—TSPP-SANTOMERSE COMBINATIONS. SEA WATER TESTS.
2 per cent Concentration Detergent.

Combination	Santomerse No. 1		Santomerse No. 55		Santomerse No. 3	
	Suds, in.	pH	Suds, in.	pH	Suds, in.	pH
TSPP 100%......	1/2	9.0	...	...	...	...
TSPP 80%, Santomerse 20%.....	4	8.8	4	8.8	4	8.7
TSPP 60%, Santomerse 40%.....	4	8.3	4	8.0	4	8.0
TSPP 40%, Santomerse 60%.....	4	7.1	4	6.9	4	6.7
TSPP 20%, Santomerse 80%.....	4	7.0	4	7.0	4	6.7
Santomerse 100%......	4	7.1	4	6.8	4	6.7

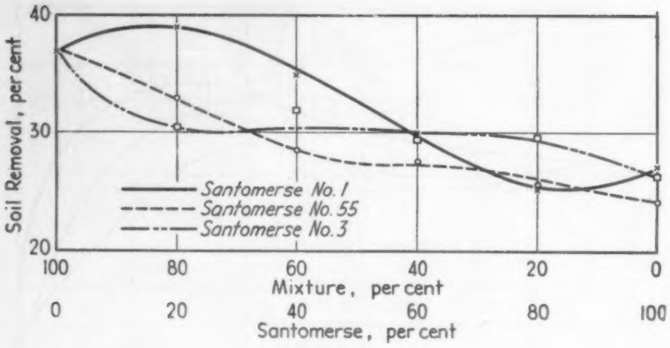


Fig. 14.

TABLE IV.—SOAP-TSPP MIXTURE - SANTOMERSE COMBINATIONS. SEA WATER TESTS.
2 per cent Concentration Detergent. Mixture—Soap 80 per cent, TSPP 20 per cent.

Combination	Santomerse No. 1		Santomerse No. 55		Santomerse No. 3	
	Suds, in.	pH	Suds, in.	pH	Suds, in.	pH
Mixture 100%......	Trace	7.9	...	...	...	...
Mixture 80%, Santomerse 20%......	1/4	7.9	1/4	8.2	1/2	8.1
Mixture 60%, Santomerse 40%......	1/2	7.8	3/4	8.1	1 1/2	8.0
Mixture 40%, Santomerse 60%......	3 1/2	7.5	3	7.9	4	7.8
Mixture 20%, Santomerse 80%......	4	7.4	4	7.7	4	7.5
Santomerse 100%......	4	7.1	4	7.1	4	6.9

ment. (A mixture of 80 per cent soap and 20 per cent TSPP had shown excellent hard water detergent results and was chosen for these tests.) The ternary combination produced unusually low soil removal as evidenced by the curves of Fig. 14 and the data of Table IV. There is no apparent explanation for this other than the fact that TSPP is a weaker base than soap, as is evidenced by pH titration data, or the possibility that the presence of inorganic salts (provided by the addition of TSPP) tended to salt the soap out of solution, which is hardly likely.

To show that TSPP is not the only alkali which will improve the sea water detergency of "Santomerse," tests were made with sodium carbonate and "Santomerse No. 1" as shown comparatively with TSPP in Fig. 15 and Table V.

In Tables VI and VII are shown the ratios of TSPP to "Santomerse" and soap to "Santomerse" at the points of

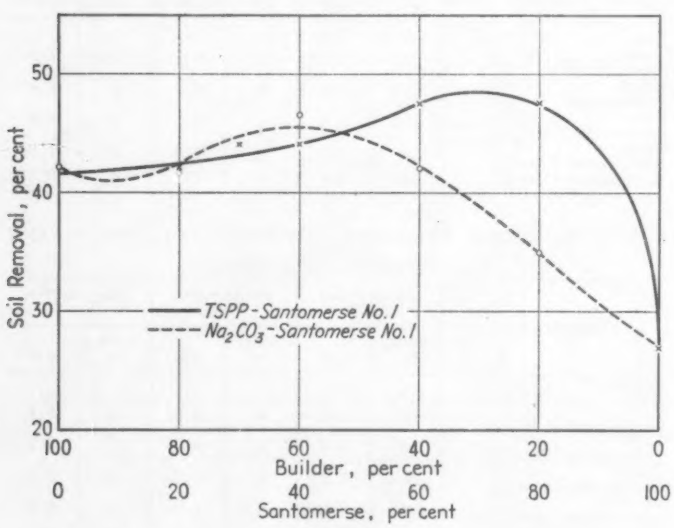


Fig. 15.

optimum soil removal. The ratio of TSPP to "Santomerse" regardless of active ingredient content approximates 1. The ratio for soap to synthetic ingredient as indicated for the 51-D-7 specification is 0.67, but it appears possible, at least for investigation at 2 per cent concentration of mixture, to obtain as good results with an 0.33 ratio when utilizing "Santomerse No. 1" as when using "Santomerse No. 55." However, the specification probably allows for a factor of safety in providing an ample amount of synthetic to yield adequate solubility and rinsability at widely variable concentrations. This is a point which should be investigated.

Conclusions

1. Extremely hard water will consume "Santomerse," as evidenced by detergency data. Sufficient "Santomerse" in relatively small amounts can be used to overcome this hard water effect.

2. An 0.8 per cent concentration of "Santomerse No. 1," and an 0.32 per cent concentration of "Santomerse No. 3" in extremely hard water produce optimum detergent results. These percentage concentrations are of equivalent active ingredient content. Absence of sodium sulfate in the "Santomerse No. 3" product results in increased detergency.

3. "Santomerse" combined with trisodium phosphate, tetrasodium pyrophosphate, or a 65 to 35 mixture of tetrasodium pyrophosphate:sodium acid pyrophosphate yielded detergent results superior to the use of "Santomerse" alone.

The combinations producing optimum detergent results follows:

(*a*) "Santomerse No. 1".......................... 0.2%
Builder.......................... 0.2%
(*b*) "Santomerse No. 3".......................... 0.08%
Builder.......................... 0.2%

4. (*a*) The three "Santomerse" products alone are poor sea water detergents.

TABLE V.—SODIUM CARBONATE - SANTOMERSE COMBINATIONS. SEA WATER TESTS.
2 per cent Concentration Detergent.

Combination	Suds, in.	pH
Sodium carbonate 100%............	Trace	10.5
Sodium carbonate 80%, Santomerse No. 1 20%............	4	10.4
Sodium carbonate 60%, Santomerse No. 1 40%............	4	10.3
Sodium carbonate 40%, Santomerse No. 1 60%............	4	10.1
Sodium carbonate 20%, Santomerse No. 1 80%............	4	10.0
Santomerse No. 1 100%............	4	8.4

TABLE VI.—COMBINATION PRODUCING OPTIMUM DETERGENCY.
TSPP—Santomerse.

TSPP, per cent	Santomerse		Ratio of TSPP to Active Ingredient
	per cent	Kind	
30	70	No. 1	0.93
35	65	No. 55	1.02
45	55	No. 3	1.22

TABLE VII.—COMBINATIONS PRODUCING OPTIMUM DETERGENCY.
Soap—Santomerse.

Soap, per cent	Santomerse		Ratio of Soap to Active Ingredient
	per cent	Kind	
55	45	No. 1	0.33
55	45	No. 55	0.45
40	60	No. 3	1.50
30[a]	20[a]	...	0.67

[a] 51-D-7 (INT) Specification (minimum).

(b) It is demonstrated that the solution pH of the 51-D-7 bar has marked effect upon detergency especially at a temperature of 140 F. For optimum detergent results pH should approach 10 as closely as possible.

(c) Optimum detergency of the 51-D-7 product is obtained at 2 per cent concentration.

5. The following conclusions are based upon 2 per cent solution concentration data:

(a) Regardless of the active ingredient content of the "Santomerse" used, all the soap-"Santomerse" combination curves fall within the range of experimental error.

(b) Statement (a) is also true for "Santomerse"-TSPP combinations.

(c) The optimum detergency ratios of soap to active ingredient for the three "Santomerse" materials are:

"Santomerse No. 1" 0.33
"Santomerse No. 55" 0.45
"Santomerse No. 3" 1.50

The ratio specified by 51-D-7 is 0.67.

(d) The optimum detergency ratio for TSPP to "Santomerse" regardless of active ingredient content is approximately 1.

(e) Soap and TSPP combined with "Santomerse" resulted in soil removal figures which declined from the soap and TSPP combination as a maximum, to the "Santomerse" materials as a minimum, without intervening rise in detergency.

(f) Sodium carbonate, as an example of other alkaline soap builders, will produce the same increase in detergent effect as for TSPP, with a ratio of sodium carbonate to active ingredient of 0.67.

Acknowledgment:

The author is indebted to Earl L. Brown who conducted these wash tests.

Factors Affecting Specific Gravity Values in the Proposed Method of Test for Soils

By Edward E. Bauer[1]

Committee D-18 on Soils for Engineering Purposes has in preparation a method of test for the specific gravity of soil particles. The author has done some work on the preparation of this test procedure and presents herewith the results of studies he has made which are directly of interest to those who make the specific gravity test on soil and to others who may make the same test on other materials.

Specific gravity is defined as the ratio of the weight in air of a given volume of a material at a stated temperature to the weight in air of an equal volume of distilled water at a stated temperature. Because materials change volume with change in temperature, the item of temperature is rather important in connection with certain materials or in the technique of performance of the test, especially if accurate results are important.

The proposed procedure provides that certain quantities of soil be used, with either a volumetric flask or a small pycnometer, and with water as the liquid. The following formula is proposed for the calculation of specific gravity:

$$G = \frac{W_o}{W_o + W_a - W_b}$$

where:

G = specific gravity of the soil particles,
W_o = oven-dry weight in grams of the soil particles,
W_a = weight in grams of flask and water at a designated temperature, and
W_b = weight in grams of flask, soil, and water at the same temperature which prevailed when weight W_a was secured.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication, or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia 2, Pa.

[1] Member of A.S.T.M. Committee D-18 on Soils for Engineering Purposes; Assistant Professor of Civil Engineering, University of Illinois Urbana, Ill.

Items Changing Volume with Change in Temperature

There are three items whose volume changes with change in temperature: the flask, the soil, and the water.

The Flask.—Glass is a material that is known to change volume with change in temperature. Is the amount significant? The coefficient of linear expansion of pyrex glass is generally accepted as 0.0000036 per deg. Cent. The volume of a pyrex glass flask at any temperature, T_f, is given by the formula

$$V_f = V_i[1 - (T_i - T_f)E]^3$$

where:

V_f = volume of the flask at temperature T_f,
V_i = volume of the flask at temperature T_i,
T_i = temperature of the flask at calibration,
T_f = some other temperature, and
E = coefficient of linear expansion of pyrex glass.

For a change of 10 C. in the temperature of the flask, the change in volume of the flask is only 0.01 per cent. If the temperature were 20 C. when weight W_a was taken, and 30 C. when weight W_b was taken, the specific gravity value of a certain soil would be 2.546 if no allowance were made for a change in the volume of the flask, and 2.548 if the allowance were made. Since a 10 C. change in temperature is rather large and amounts only to a difference of 0.002 in the specific gravity value, it appears: (1) that no attention need be paid under ordinary circumstances to the change in volume of the flask, and (2) that this provision can be eliminated from the proposed test procedure.

The Soil.—No data are available that the volume of the soil particles themselves change an appreciable amount with small change in temperature and in this study are, therefore, assumed not to change a significant amount.

Choice of Temperature

In the method as submitted to the Society's Committee E-10 on Standards, it was proposed that the flask and contents be brought to a temperature of 25 C. when both weights W_a and W_b are taken. Committee E-10 has suggested that 20 C. be substituted. The question of which temperature to use has little practical significance since values are affected only in the third decimal place. Table I shows that values based on water at 20 C. differ only 0.0045 to 0.005 from values based on water at 4 C. The difference between values based on water at 25 C. and at 20 C. is approximately 0.003. Even though the effect of temperature is not large here, it is desirable to specify some temperature at which test values are to be reported, thus following the established practice for other materials.

TABLE I.—COMPARISON OF SPECIFIC GRAVITY VALUES OF SOILS BASED ON WATER AT VARIOUS TEMPERATURES.

4 C.	15 C.	20 C.	25 C.	30 C.
2.50000	2.50218	2.50442	2.50733	2.51085
2.60000	2.60227	2.60460	2.60762	2.61129
2.70000	2.70236	2.70478	2.70791	2.71172
2.80000	2.80245	2.80495	2.80821	2.81215

Temperature when Two Weights Are Taken:

In the proposed formula for specific gravity, two weights are required, W_a and W_b, and the discussion so far might lead one to believe that no attention need be paid to the temperature of the flask and contents when these weights are determined. A study of the tabulation in Table II indicates that an appreciable error can be introduced if there is a difference in the temperatures at the times when the two weights are taken and if no allowance is made for this difference. The error is larger for the larger temperature values and for greater differences of the two temperatures.

TABLE II.—SPECIFIC GRAVITY VALUES COMPUTED FROM FORMULA WITH NO ALLOWANCE MADE FOR CHANGES IN TEMPERATURE BETWEEN READINGS FOR W_a AND W_b

Values are for a soil having a specific gravity of 2.6000 based on water at 4 C.

Temperature, deg. Cent.		Percentage of Flask Occupied by Water	Specific Gravity
W_a	W_b		
20	25	80	2.593
25	20	80	2.620
20	25	90	2.578
25	20	90	2.635
25	30	90	2.575
30	25	90	2.645
20	30	90	2.546
30	20	90	2.673
20	20	90[a]	2.605
25	25	90[a]	2.608

[a] When both temperatures are the same the percentage of flask occupied by water has no effect on the specific gravity value.

The proposed procedure provides for the condition when a single determination is made and an alternate method when a large number of tests is to be made. In the single determination procedure, it is specified that the flask and contents be brought to a designated temperature, while in the alternate method it is proposed that the temperatures be observed when weights W_a and W_b are taken and that proper allowance be made in making the calculations.

For laboratories making several or more specific gravity determinations, it is much more convenient to prepare a calibration table of weights, W_a, for a range of temperatures likely to prevail in the laboratory, than it is to bring the flask and contents to any specified temperature. Each time a determination is made, the temperature is observed when weight W_b is secured, and the weight W_a corresponding to this temperature is taken from the table. The formula is solved, and the value secured is based on water at the observed temperature.

TABLE III.—RELATIVE DENSITIES OF WATER AND CORRECTION FACTORS[a] FOR TEMPERATURE VALUES FROM 20 C. TO 30 C.

Temperature, deg. Cent.	Relative Density of Water[b]	Correction Factors[a]
20	0.9982343	1.000000
21	0.9980233	0.999789
22	0.9978019	0.999567
23	0.9975702	0.999335
24	0.9973286	0.999093
25	0.9970770	0.998841
26	0.9968158	0.998579
27	0.9965451	0.998308
28	0.9962652	0.998027
29	0.9959761	0.997738
30	0.9956780	0.997439

[a] Correction factor is used to change a specific gravity value based on water at some temperature to a value based on water at 20 C.
[b] Relative density values are taken from *Smithsonian Physical Tables*, Eighth Edition, 1933, Smithsonian Institution, Washington, D. C.

Changing Specific Gravities to Values Based on Water at Various Temperatures:

If it is felt that this value should be changed to water at 4 C., the value obtained should be multiplied by the relative density of water at the observed temperature. If it is desired to report the value based on water at 20 C., it is necessary to multiply the value by the correction factor taken from Table III. These correction factors have been computed by dividing the relative density of water at each temperature by the relative density of water at 20 C.

Preparation of Table of Weights, W_a:

The preparation of the table of weights, W_a, for the range of temperatures likely to prevail in the laboratory is done as follows: Clean and dry the flask and determine its weight. Fill the flask to the calibration mark with distilled water. Weigh the flask and contents and take the temperature of the water. Divide the weight of water in the flask by the relative density of water at the observed temperature. The answer is the volume of the flask. The weight of water which would be in the flask at another temperature is found by multiplying this volume by the relative density of water at the other temperature desired. The weight of the flask is added in each case to secure the weight W_a. Once a table is prepared it can be used during the full lifetime of the flask.

Volume of Flask Occupied by Water:

As the ratio of the volume of water to the volume of the soil in the flask increases, the greater is the need to have weights W_a and W_b based on water at the same temperature, as indicated by the values in Table II.

Summary

The above study indicates: (1) that no correction need be made for changes in the volume of the flask due to changes in the temperature of the flask and contents when the two weights W_a and W_b are taken, (2) it is important that the weights W_a and W_b are for the same temperature, and (3) there is very little difference in the specific gravity value based on water at temperatures likely to prevail in a laboratory.

Committee on Industrial Aromatic Hydrocarbons

Committee D-16 Organizes at Meeting

A NEW A.S.T.M. COMMITTEE, D-16 on Industrial Aromatic Hydrocarbons, was organized at a meeting held in New York on October 26—the personnel of the group was approved and temporary officers were selected. The first four subcommittees which will undertake work were agreed upon. This new standing committee of the Society was authorized after the A.S.T.M. Executive Committee had considered suggestions from a number of sources that such a group could contribute much in this field through the development of standard methods of tests, definitions, and specifications for these materials and related products which boil below 400 F. Products covered by the committee would include various grades of benzene, toluene, xylene, solvent naphthas, and similar hydrocarbon products.

Officers: *(See photograph on page 46)*

The temporary chairman of the committee is J. M. Weiss, Consulting Chemical Engineer, New York N. Y., an authority in this field who has devoted considerable time to many of the technical problems and who has been very active in A.S.T.M. work. The temporary secretary is R. P. Anderson, Secretary, Division of Refining, American Petroleum Institute. C. A. Lunn, Process Engineer, Consolidated Edison Co., New York, N. Y., is vice-chairman. These officers will serve until June, 1944, when the committee will select permanent officers. The Advisory Committee which will serve as the administrative group will consist of the three officers, plus the chairman and vice-chairman of each of the subcommittees as indicated below:

Subcommittees:

As with the some 60 other A.S.T.M. standing technical Committees, detailed work involving research, actual drafting of the standards, etc., will be carried out through subcommittees, varying in numbers depending on the scope.

The following subcommittees are being organized with officers as indicated.

Subcommittee:

- I Methods of Test of Crude Aromatic Products—C. A. Lunn, *Chairman;* D. F. Gould, *Vice-Chairman.*
- II Methods of Test of Refined Aromatic Products—V. J. Altieri, *Chairman;* E. T. Scafe, *Vice-Chairman.*
- III Specifications for Aromatic Chemicals—J. N. Wickert, *Chairman;* Wesley Minnis, *Vice-Chairman.*
- IV Specifications for Aromatic Solvents—R. E. Ruthruff, *Chairman;* L. A. Wetlaufer, *Vice-Chairman.*

Committee Personnel:

The A.S.T.M. policy of arranging the personnel of its technical committees to include qualified technical representatives of leading producers, consumers, and general interest groups continues with Committee D-16. The personnel of the committee, as organized, is as follows:

(p) V. J. Altieri, Eastern Gas & Fuel Associates, Everett, Mass.
(p) R. P. Anderson, American Petroleum Institute, New York, N. Y.
(c) Bakelite Corp.
H. E. Riley, Bloomfield, N. J.
(p) Barrett Division, Allied Chemical and Dye Corp.
D. F. Gould, Philadelphia, Pa.
(gi) Bureau of Mines, U. S. Department of Interior
W. A. Selvig, Pittsburgh, Pa.
(c) Calco Chemical Division, American Cyanamid Co.
E. C. Medcalf, Bound Brook, N. J.
(c) Carbide and Carbon Chemicals Co.
J. N. Wickert, South Charleston, W. Va.
(p) Carnegie-Illinois Steel Corp.
C. B. Francis, Pittsburgh, Pa.
(p) Committee D-1 on Paint, Varnish, Lacquer, and Related Products
D. F. Gould, and alternate, E. M. Toby, American Spirits Co., New York, N. Y.
(c) Committee D-11 on Rubber Products
J. F. Anderson, B. F. Goodrich Co., Akron, Ohio
(p) Consolidated Edison Co. of New York, Inc.
C. A. Lunn, New York, N. Y.
(c) Devoe and Raynolds Co., Inc.
C. E. Rodgers, Louisville, Ky.
(c) Dow Chemical Co., The
A. W. Beshgetoor, Midland, Mich.
W. H. Williams, Midland, Mich.
(c) du Pont de Nemours and Company, Inc., E. I.
L. A. Wetlaufer, Philadelphia, Pa.
(gi) W. H. Fulweiler, Philadelphia, Pa.
(c) General Electric Co.
C. Dantsizen, Schenectady, N. Y.
(p) Jones and Laughlin Steel Corp.
B. E. Stewart, Pittsburgh, Pa.
(p) Koppers Co., Tar and Chemical Division
J. N. Roche, Pittsburgh, Pa.
(c) Monsanto Chemical Co.
M. T. Kelley, St. Louis, Mo.
(c) National Aniline Division, Allied Chemical and Dye Corp.
Wesley Minnis, Buffalo 10, N. Y.
(c) Pittsburgh Plate Glass Co., Paint Varnish Division
Paul R. Croll, Pittsburgh, Pa.
(p) Reilly Tar and Chemical Co.
Malcolm Mitchell, Indianapolis, Ind.
(gi) Rubber Reserve Co.
Oliver W. Burke, Washington, D. C.
(p) Shell Development Co.
F. D. Tuemmler, Emeryville, Calif.
(c) Sherwin-Williams Co., The
R. F. Ruthruff, Chicago, Ill.
(p) Socony-Vacuum Oil Co., Inc.
E. T. Scafe, Paulsboro, N. J.
(p) Standard Oil Co. of California
C. F. Ramey, San Francisco, Calif.
(p) Standard Oil Co. (Indiana)
W. H. Bahlke, Whiting, Ind.
(p) Standard Oil Development Co.
A. P. Hewlett, Elizabeth, N. J.
(p) The Texas Company
W. L. Douthett, New York, N. Y.
(p) Sun Oil Co.
J. Bennett Hill, Philadelphia, Pa.
(c) U. S. Navy, Bureau of Ships
Officer-in-Charge, Standards and Tests Section, Washington, D. C.
(c) War Department, Office of Chief of Ordnance
C. R. Cornthwaite, Washington, D. C.
(gi) John M. Weiss, New York, N. Y.

ASTM Bulletin

DECEMBER 1943

NO. 125

TWO-SIXTY
SOUTH BROAD ST.
PHILADELPHIA, PENNA.

The A.S.T.M. Year Book—Committee Roster

A Year Book of any organization, including the A.S.T.M. version, might seem a prosaic enough publication. Usually the names of the members deceased during the year are included, something about the organization's objectives, prize awards, etc., the officers are listed and a considerable portion is devoted to the names of members. Some year books give rather sparse information about members. A.S.T.M. has always included latest information on industrial connections, titles, mailing addresses, etc., and the 1943 Year Book[1] which was completed in November continues this practice, with a further change that was one of the factors delaying the publication somewhat, the insertion of mailing zone numbers.

The A.S.T.M. Year Book is unusually unique, however, in one respect. Just half of the 374-page volume is devoted to listing complete personnel of the more than sixty standing technical committees (185 pages to be exact). This situation leads to one definite conclusion—they must hold an important place in the A.S.T.M. scheme of things. Their work in standardization and research, of course, is paramount.

In one sense it is unfortunate that we cannot coin a better word for these technical groups than "committees" because while they are creatures of the Society and report to it, each is really a small organization in itself with a considerable degree of autonomy and a permanency beyond the usual connotation of the term "committee." If any member wishes to get some concept of the extent of A.S.T.M., there is no better way than to leaf through the material in his Year Book beginning on page 143.

[1] Note.—The Year Book is furnished to members on request.

At the Peak or on the Slope?

Statistics on 1943 membership, finances, and standardization activities and other data which relate to the Society will indicate a banner year—in fact, on several scores, will indicate peak figures. The Society is indeed in a very encouraging position as viewed from the statistical angle.

There are perhaps two different views on the present position—first, the extremely optimistic one, isn't it wonderful!; haven't we made remarkable progress! But there is a second view that despite the remarkable showing, A.S.T.M. is a long, long way from reaching its maximum usefulness with respect to membership, standardization activities or research, and the like. It was Carl Hubbell, the almost ageless southpaw pitcher who stated, "A fellow doesn't last long on what he has done. He's got to keep on delivering as he goes along."

Not that there is any thought of coasting along. This Bulletin and other Society publications indicate A.S.T.M. is extending its work into new fields and intensifying activities in the old ones. There is justification perhaps for maintaining a feeling of mild dissatisfaction since this may aid in keeping all of us in the Society on our toes.

Our Primary Responsibility

Among the national technical societies, the American Society for Testing Materials stands out as the one which has as its principal objective the development of standard specifications and methods of test for materials as the other organizations have these subjects only as auxiliary to their main purpose. We therefore are recognized throughout the country as the organization having the primary responsibility for the specifications and testing of materials.

This responsibility of course implies that we adequately cover the field of materials with suitable standards and that other organizations and individuals desiring such standards should look to us for leadership along these lines.

Our plan of organization Standing of Committees properly representative of producers, consumers, and general interests provides an excellent basis for the preparation of suitable standards, as all interests are given consideration.

Another factor of importance is the conservative policy followed by the Society, which provides that in general a standard shall not be adopted until it has been on trial for at least one year. During this period as a tentative standard it is available for use and an opportunity is provided to make any changes which are found necessary.

The work of the standing committee which has prepared a standard is not completed when the standard has been issued. The committee then is expected to cooperate with the Headquarters Staff in such publicity as is necessary to bring it into general use. The committee also is responsible for maintaining the standard, making such revisions from time to time as are necessary to keep it in accordance with the best current commercial practice.

The interest of other organizations in the development of material specifications and methods of testing by the American Society for Testing Materials is shown by the fact that over 75 technical, scientific and trade organizations have official memberships on our standing committees.

On our part, we are the sole or joint sponsor for 15 sectional committees functioning under the procedure of the American Standards Association.

In numerous other cases, our representatives are acting on joint committees, covering such fields as effect of temperature upon the properties of metals, filler metal, auto-

motive rubber, boiler feedwaters, where broad investigations are being made of the performance of materials in service, in some cases leading to standards.

The Society at all times welcomes the cooperation of organizations interested in its work.

Dean Harvey

President.

1944 Nominating Committee

In accordance with the By-laws, providing that the Executive Committee shall select a nominating committee for officers at its October quarterly meeting, the Executive Committee has considered the report of the tellers, H. S. Phelps, Engineer, Special Investigation and Testing Div., The Philadelphia Electric Co., Philadelphia, Pa., and F. B. Lysle, Bureau of Lighting and Gas, Philadelphia, Pa., on the recommendation of members for appointees on the nominating committee and selected the following committee and alternates:

Members	Alternates
L. E. Ekholm	L. P. McAllister
L. A. Wagner	W. C. Hanna
W. A. Zinzow	L. W. A. Meyer
P. J. Freeman	Sabin Crocker
F. L. LaQue	J. R. Freeman
J. J. Allen	A. W. Carpenter

The three immediate past-presidents—W. M. Barr, G. E. F. Lundell, and H. J. Ball—serve as *ex-officio* members of the 1944 Nominating Committee. The committee will meet in March and make nominations for each office—president, vice-president, and five Members of the Executive Committee. The selections by the nominating committee will be announced to the members in the ASTM Bulletin prior to transmission of official ballots.

Dudley Medal Committee Appointed

The Committee on 1944 Award of the Charles B. Dudley Medal has been appointed by the Executive Committee and consists of the following members:

Cloyd M. Chapman, *Chairman*, Consulting Engineer
Lloyd W. Hopkins, Sales Engineer, American Chain and Cable Co.
L. S. Reid, Senior Technician, Standardization Laboratory, Metropolitan Life Insurance Co.

This committee will review the eligible technical papers presented during 1943 and select the one of outstanding merit which constitutes an original contribution on research in engineering materials. The award will be made at the Forty-seventh Annual Meeting to be held in New York City, June 26 to 30, 1944. This Medal was established in 1925 by voluntary subscriptions from members of the Society as a means of stimulating research, recognizing meritorious contributions to the Society's publications, and in commemoration of the first President of the Society whose leadership has profoundly influenced A.S.T.M. development.

Marburg Lecture Committee

The committee which will select the Edgar Marburg Lecturer for 1944 has been appointed. Under the rules governing the lecture, this group consists of a member of the Executive Committee, a member of Committee E-9 on Research, and a member of Committee E-6 on Papers and Publications. The personnel, representing the respective committees in the order named, is as follows: Past-President H. J. Ball, Professor of Textile Engineering, Lowell Textile Institute, Lowell, Mass.; R. J. Moore, Manager, Development Laboratories, Bakelite Corp., 230 Grove St., Bloomfield, N. J.; and P. G. McVetty, Mechanical Engineer, Research Laboratories, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. Professor Ball is serving as chairman.

List of Standards on Request

Any members of the Society or others concerned with A.S.T.M. specifications and tests can obtain on request copies of a 40-page *List of A.S.T.M. Standards and Tentative Standards* which under appropriate headings gives the titles and latest designations of all the specifications and tests. This list is effective as of October, 1943. With the booklet is a supplementary list of all A.S.T.M. emergency specifications and emergency alternate provisions.

While the *List of Standards* is used by A.S.T.M. Headquarters primarily in connection with inquiries, members may find it useful pending publication of the 1943 Index to Standards which will give latest references to publications where the Society standards appear. This Index is a combined index to all parts of the Books of Standards and Supplements and a copy will be sent (in January or early February, 1944) to each member and each purchaser of the 1942 Book of Standards and 1943 Supplements.

1944 A.S.T.M. Meetings

Previous announcement has been made that the 1944 Spring Meeting will be held in Cincinnati on March 1 or 2, during the A.S.T.M. Committee Week extending from Monday, February 28, probably through Friday, March 3. Recently the Executive Committee has decided to hold the 1944 Annual Meeting, the Forty-seventh, at The Waldorf-Astoria in New York, during the week of June 26–30.

While Atlantic City had been recommended as first choice for the 1944 Annual Meeting, first-hand information was developed indicating great uncertainty on the ability of hotels to take care of the meeting requirements satisfactorily and furthermore, it appeared likely that railroad transportation would be very poor. In view of these situations, New York City, the second choice, was selected and plans are under way both by Committee E-6 on Papers and Publications respecting the technical program, and also by the New York District Committee, which will be in charge of local arrangements. One of the Society's most successful annual meetings was held in New York in 1937 with a banner attendance, strong technical program, and exhibit of apparatus and equipment. No exhibit is contemplated during 1944.

Important Publications Issued; Several New Books

MORE THAN 2300 PAGES of printed material are represented in the several technical publications, compilations of standards, etc., issued by A.S.T.M. during the months of October and November, and by the end of the year this figure will be considerably higher. Making this figure bulk large are the five special compilations of A.S.T.M. standards, some with considerable other related information. These are as follows:

Steel Piping Materials—265 pages.
Petroleum Products and Lubricants—450 pages.
Paper and Paper Products—144 pages.
Textile Materials (with Related Information)—476 pages.
Plastics—440 pages.

A-1—Steel Piping Materials:

The so-called piping compilation gives the some 30 A.S.T.M. specifications covering pipe and boiler, superheater, and miscellaneous tubes, and the some 15 other specifications covering castings, fittings, and bolting used in piping work, both for elevated and for normal temperatures. These specifications are the work of Subcommittee IX on Steel Tubing and Pipe and Subcommittee XXII on Valves, Fittings, Piping, and Flanges for High-Temperature and Subatmospheric Temperature of Committee A-1 on Steel. Many of the standards are incorporated in the WPB Limitation Order L 211 as part of the pipe and tubing schedules in the development of which many of the A-1 members have had a leading part. A feature of this book is the grain size chart for steels (E 19) and also the inclusion (affixed to the respective standards) of the several emergency alternate provisions (pink slips). $1.25 per copy to members.

D-2—Petroleum Products and Lubricants:

This compilation of all of the some 91 specifications, tests, and definitions relating to petroleum products is the oldest from the standpoint of continuity of publication, is one of the largest from the standpoint of pages, and is the most widely distributed. There is hardly any reasonably sized laboratory where petroleum testing and research are carried out that would not have one or more copies of this book. Each year Committee D-2 has recommended the inclusion of its latest report thus itemizing changes in the standards, and affording information through subcommittee reports of data developed in committee investigations. This year there is information on the work on oxidation of turbine oils, and two proposed tests—one for saponification number, by electrometric titration, and the other for oxidation characteristics of steam-turbine oils. $1.50 per copy to members.

D-6—Paper and Paper Products:

Sponsored by Committee D-6 on Paper and Paper Products this publication is the first giving in convenient form all of the test methods and specifications developed by A.S.T.M. relating to this field. Of the 37 standards, 31 provide methods of testing, while six are specifications. Committee D-6 is one of the relatively newer A.S.T.M. standard groups and the issuance of this special compilation is indicative of the intensive work carried out by the committee. $1.00 per copy to members.

D-13—Textile Materials (with related Information):

It will be seen that this compilation sponsored annually by the Society's largest technical committee, D-13 on Textile Materials, is the most voluminous of the special compilations noted. This is true in part because of the committee's desire to make the publication as serviceable as possible and therefore there are included in appendices considerable material other than specifications and tests, which includes a table of basic properties of textile fibers, yarn number conversion table, psychrometric table for relative humidity, extensive glossary of terms relating to textiles (including a detailed list of man-made and natural fibers) and several proposed tests and other related information. This year's book is featured also by the Presidential address by Past-President H. J. Ball on "The Relation of the A.S.T.M. to the Textile Industry," as well as abstracts of three technical papers. This book has grown to occupy an important place in the library and reference files of textile technologists. $1.50 per copy to members.

D-20—Plastics:

An unusual feature of this publication which includes all of the specifications and tests developed by Committee D-20 on Plastics and also a number issued through the work of Committee D-9 on Electrical Insulating Materials is its status as a second edition during the same year. Knowing that the committee was completing a number of specifications and some tests the printed edition of the first compilation in May, 1943, was limited to 1200 copies, but they were distributed on demand so rapidly that in a few weeks all of the copies had been sold. The printing order for this second edition is sufficient, it is believed, to cover all normal needs. Committee D-20 has been extremely active within the past year, particularly in connection with its specifications, and prior to that for many months had concentrated on the development of satisfactory test methods, many of which are incorporated as essential parts of the purchase standards. All told, there are 19 specifications, and more than 58 standard methods of testing. $1.50 per copy to members.

Symposiums; Lecture

Following the usual practice, the current Edgar Marburg Lecture, delivered in 1943 by L. J. Markwardt on the subject "Wood as an Engineering Material," is printed in special pamphlet form prior to its inclusion in the 1943 *Proceedings* (distribution early February, 1944). This lecture covering some 60 pages with a large number of interesting illustrations is outstanding in the series of notable technical contributions. Members who wish to procure separate copies can obtain them at 75 cents each.

Symposium on Paint, and on Powder Metallurgy:

Each of these symposiums comprises the technical papers and discussion presented at the sessions held at the March, 1943, A.S.T.M. Buffalo Spring Meeting. Outstanding

authorities contributed the technical papers and the publications are considered of much value in the respective fields. Mention might be made of one paper in the Symposium on Paint, the one on "Protective Concealment Paints" by Dr. Paul O. Blackmore. Because of the intense interest in concealment work the paper was not only very timely, but from the standpoint of completeness and comprehensiveness a very notable one. The large number of illustrations make it very interesting also. As indicated on the Members' Order Blank sent to each member on November 22, copies of these symposiums can be obtained by the members at 75 cents each.

Philadelphia Meetings—Aircraft; Plastics

Dr. L. B. Tuckerman, Assistant Chief, Div. of Mechanics and Sound, National Bureau of Standards, who needs no introduction to an A.S.T.M. audience will be the chief speaker at a meeting being sponsored by the Philadelphia District at the Franklin Institute on Thursday, December 16. He has selected as his subject the discussion of "Critical Instability" and will discuss particularly some of the problems involved in this topic as related to the aircraft field. A subtitle of the talk might be "The Colonel's Lady and Judy O'Grady Are Sisters under Their Skins." Invitations are extended to all members and those interested to attend. There will be an informal dinner preceding the meeting at Holland's Restaurant.

Symposium on Plastics

With the close cooperation of the officers of Committees D-9 on Electrical Insulating Materials and D-20 on Plastics, the Philadelphia District Committee is planning for an extensive Symposium on Plastics to be held during the four-day series of meetings of D-9 and D-20 in Philadelphia during the week of February 21. Since the Plastics Symposium held as a technical feature of the Spring meeting in Rochester in 1938, there have been a number of papers presented at A.S.T.M. meetings and during the past few years many notable technical developments have evolved. The committee is enlisting the support of outstanding authorities in this field as authors of papers. This preliminary announcement is intended merely to acquaint A.S.T.M. members with the fact that the symposium is being planned and to note the dates on their calendar. It will be scheduled on one or two of the following dates, February 22, 23, 24. Further details in the January Bulletin.

Chicago Technical Societies Council

Organization has recently been completed of a Chicago Technical Societies Council which will provide a common instrumentality for all groups interested in the broad and inclusive phases of modern engineering, technical and scientific studies. Most of the leading technical and engineering organizations with headquarters or branches in the Chicago District are represented in the Council. The A.S.T.M. Chicago District Committee is participating in the work and is represented by J. F. Calef, Automatic Electric Co., and E. R. Young, Climax Molybdenum Co., who is chairman of the District Committee. Mr. Calef is serving as chairman of the Council's finance committee. There are a number of objectives stated in the Council's platform, but they will not duplicate activities or overlap functions of the various member groups. Two important projects already under way include the regular publication of a complete calendar of coming events, and preparation of a Who's Who of the Engineering, Technical and Scientific Men of the Chicago Area. A number of A.S.T.M. members who are representing other societies and groups have had an active part in development plans.

Outstanding Detroit Meeting on Corrosion

Under the auspices of the Detroit District Committee, there is being held at the Hotel Statler, Detroit, on December 9 a dinner and technical session which will have as the chief feature a Symposium on Corrosion, with three authors presenting papers as the basis for discussion. Detailed announcements have been forwarded to all members in the Detroit area and to several thousand members affiliated with organizations that are concerned with corrosion problems. General arrangements have been carried out by the Detroit District Committee under the chairmanship of C. H. Fellows, Detroit Edison Co., with several members cooperating in connection with program, dinner, etc.; further details of the meeting will appear in the January Bulletin. The three papers are as follows:

Mechanism of Corrosion Processes by Robert M. Burns, Assistant Chemical Director, Bell Telephone Laboratories, Inc., New York, N. Y.

Stress Corrosion by E. H. Dix, Jr., Assistant Director of Research and Chief Metallurgist, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa.

Recent Knowledge of Corrosion Couples and Galvanic Action by R. H. Brown, Electrochemist, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa.

War Department Representation on Committees

For many years the U. S. War Department has been concerned with the work of the Society and through its wide representation on technical committees has taken an active part in many phases of A.S.T.M. work. This has grown to such an extent that the Department has centralized its supervision over its representation on the technical committees of various societies and associations. In the case of A.S.T.M., a conference was held to discuss how the Department might rearrange its setup so that the varied interests are adequately represented on quite a number of A.S.T.M. technical committees. In general the War Department will be set up as the main Committee listing, with the Ordnance Dept., Arsenals, Signal Corps, Quartermaster Dept., and others listed separately under the Department. Early in November a complete list of the Department representatives, and related material, was sent to the officers of the committees in the Society which would be concerned.

Philadelphia Meeting Looks at Life and Motion

A most unusual and interesting meeting was held on October 28 at the Franklin Institute under the auspices of the Philadelphia District Committee featuring addresses by three of the country's outstanding scientists—Dr. F. F. Lucas, authority on microscopy; Dr. Mary B. Stark, a pioneering leader in cancer research; and Dr. J. F. Mahoney, a leader in venereal disease research. The factor which brought these three people together on the same platform was their interest in ultraviolet microscopy and its application to micro-motion picture equipment, in which Doctor Lucas has been the leader.

There were about 450 in attendance including many of Philadelphia's medical leaders. Frank G. Tatnall, chairman of the Philadelphia District Committee, introduced A.S.T.M. Vice-President J. R. Townsend, who served as technical chairman, and he in turn introduced the speakers, including Dr. Hubley R. Owen, Philadelphia's Director of Health, who welcomed the guests. The A.S.T.M. President, Dean Harvey, attended the meeting and spoke briefly.

Doctor Lucas in his presentation covered briefly the development of the ultraviolet microscope, particularly the micro-motion picture equipment, and then showed a film applying this new research tool to work on Hevea, balata, and synthetic latices, and other materials where Brownian motion is present. This is one of the interesting industrial applications of this tool, enabling the investigator to evaluate particle size variations, shapes of particles, and other factors which might affect the applications of the materials.

The studies which led to the actual showing on the screen of particles and other items magnified 20,000 to 30,000 times came about through Doctor Lucas' original work in metallography with resultant previously unheard-of magnifications, the unsuccessful use of the ultraviolet instrument for metals because prepared surfaces absorb most of the light, and then the rebirth of interest and application of the instrument in biological and medical research.

Dr. Mary B. Stark, New York Medical College, whose work in breeding strains of mice and other forms of life with recurring tumors, has made her world famous, described some phases of her work on hereditary tumors and the applications of the ultraviolet microscope.

Then followed one of the highlights of the evening—the talk by Dr. J. F. Mahoney on his venereal disease research work and the development of the life history of the syphilis spirochete through step-by-step motion picture photography. Only through viewing the film could one realize the rapidity of the spiral movement combined with flexing, the different forms (motile and nonmotile) taken by parts of a syphilis spirochete; and the possible explanation of reproduction.

While there were many additional ramifications of the subject covered by each of the three speakers the audience indicated its interest throughout.

One of the interesting questions stemming from this work involves movement of bacterial organisms and how it comes about. Apparently there is a much closer connection between the latex films, obviously of lifeless material, and bacterial films, than casual observation might indicate. When certain bacteria get into a rubber latex preparation they perform exactly as rubber particles. That is to say, they carry electrical charges which apparently are constantly varying in intensity, polarity, and position on the particle. The shifting in charge does not permit equilibrium conditions among particles. Equilibrium is approached when only a very few particles are present, as seen on the screen. Add more particles and there is obviously more motion. From the electrical sequence it was established that the spirochetes also carry charges and it could be seen throughout the films by the behavior of colloidal particles about the spirochetes. The films clearly show that these organisms can, at least under some circumstances, thread their way through a field of stationary particles in the medium. It looks very much as though these particles were positively charged and the spirochetes also positively charged, and instead of bumping into the particles they mutually repel each other and the organism dodges around them.

Preceding the meeting there was an informal dinner at the Engineers' Club with about 75 present including Society officers, speakers, members, and guests.

Cooperating closely with Chairman Tatnall were J. F. Vogdes, Jr. (Promotional), E. J. Albert (Dinner), and Messrs. A. O. Schaefer, L. E. Ekholm, W. J. Jeffries, and E. K. Spring (Seating, etc.).

Offers of Meeting Papers Requested by February 1

Committee E-6 on Papers and Publications is extending to all materials and testing engineers the customary invitation to offer papers on subjects relating to the properties and testing of engineering materials for presentation at the 1944 Annual Meeting in New York City.

It is most important this year that the program of our Annual Meeting be developed at an early date so that transportation and hotel reservations may be made well in advance. Also, in order that as many as possible of the technical papers and committee reports can be preprinted in advance of the meeting, it is desirable that all offers for papers be received early so that final acceptance can be made and the typesetting started at an early date. Committee E-6 has, therefore, fixed February 1 as the limiting date for receipt of offers but members who may be considering the submission of a paper are urged to send their offers to A.S.T.M. Headquarters *as soon as possible.* Suitable blanks which should be used in sending the necessary information with respect to the offer of a paper can be obtained from the Society offices. Each offer must be acpanied by a summary of the proposed paper in such detail that its scope is clear and also to point out features that in the author's opinion make the paper a desirable one for presentation and discussion.

A.S.T.M. Spring Meeting, Cincinnati, Ohio
Week of Feb. 28

Material Substitutions and Supply List No. 10

October, 1943

THE SUCCESS OF the war program and the maintenance of civilian war economy depends on the most efficient utilization of some 500 materials. In the Material Substitutions and Supply List the current relative availability of the most important of these is indicated.

Three degrees of criticalness are listed. The supply of those materials in group I is *insufficient* to satisfy war plus essential industrial demands. Those in Group II are currently *sufficient* to satisfy these same needs. Group III materials are *in excess* of current *essential* needs.

Revisions of the list are made quarterly by the WPB Conservation Division, in conjunction with the various Materials Divisions and the Statistics Division, of War Production Board. Copies are available for Army, Navy, all Government agencies, and interested individuals or organizations, in this or in allied countries.

Notes and Suggestions:

When large metal tonnages are involved first consideration should be given to the ferrous materials to avoid disrupting the supply of any smaller tonnage non-ferrous or plastic materials.

For new applications the choice between steel and wood should be based largely on the type of need, the application, and local conditions of supply.

Because of manpower situations or processing facilities, particularly among certain non-ferrous metals, certain fabricated forms, such as aluminum permanent mold castings, are much tighter than either the metals themselves or other fabricated forms.

Due to manpower shortages greater emphasis should be placed on the use of materials best suited to low unit labor processes such as stamping, die molding and die casting, automatic screw machines, etc.

Considerable conservation can be effected, particularly in castings, by the use of substitute alloys, possessing similar characteristics but somewhat lower purity than normally specified. To assist this, the Conservation Division has prepared two charts: "Conservation Chart for Brass and Bronze," newly reissued, and "Aluminum Alloy Substitution Chart."

Changes:

The easing of many non-ferrous metals into Group II in this issue and the even more marked easing of ferro-alloys only indicate that these materials in unfabricated form are now sufficient to supply essential war and industrial needs. There is no present indication that any of them will be available soon for general use, or that restrictive orders regarding such use can be lifted.

Of the Controlled Materials, Copper and Steel are listed in Group I, Aluminum in Group II, although certain fabricated and semifabricated forms of steel that are in somewhat freer supply than steel ingot are continued still under the heading of Steel Construction Materials in Group II. Recently it has been found that military requirements, which utilize most of these controlled materials, must retain such flexibility that it is no longer possible to estimate the details of what will be available for other demands. Hence, anyone contemplating any product revision that will require additional controlled materials or products under allocation should first consult with the Claimant Agency or the WPB Division responsible for the product involved, to be sure that allotments can cover this proposed new demand.

Certain synthetic rubbers are freer, while a few chemicals, including sulfuric acid, are tighter. Chemicals have been revised to conform more fully with the requirements program.

Group I

Supplies of the following materials are *insufficient* for war plus essential industrial demands under existing administrative controls. Substitutes or lower grade materials should be used whenever possible.

In Group I the order of listings within each subgroup indicates relative criticalness only under *A. METALS* and under *B. PLASTICS*.

A. METALS

(See italics under "Changes")

a—Metals:
- Platinum
- Cadmium
- Tin
- Bismuth
- Beryllium
- Copper (Controlled Material)
- Steel (Controlled Material)

b—Ferro Alloys:
- Tantalum
- Nickel
- Columbium

c—Basic Irons:
- Low Phosphorus Pig Iron
- Malleable Cast Iron

B. PLASTICS

a—Thermoplastic:
- Vinylidene Chloride Polymers
- Polystyrene
- Ethyl Cellulose
- Cellulose Acetate Butyrate

c—Miscellaneous:
- Cellulose Sponge
- Vulcanized Fiber—heavy gages 0.030" and up

C. CHEMICALS

- Acetaldehyde
- Acetic Anhydride
- Acetic Acid
- Acetone
- Alcohol: Amyl, Butyl (all Isomers and Derivatives except Tertiary), Capryl, Lauryl, Methyl, N-Octyl
- Aluminum Sulfate: Iron-Free
- Aluminum Trihydrate
- Aniline and Derivatives
- Anthraquinone and Derivatives
- Aromatic Petroleum Solvents
- Arsenic and Derivatives
- Barium Perchlorate
- *Benzol and Derivatives
- Butyl Acetate
- Butyl Cellulose
- Calcium Cyanamide and Derivatives
- Calcium Hypochlorite High Test
- Carbon Bisulfide
- Cobalt Chemicals
- *Cresols
- Dichlorethyl Ether
- Dichlorodifluoromethane (Freon 12)
- Diphenylamine
- Ethyl Acetate
- Formaldehyde and Paraformaldehyde
- Hexamethylenetetramine
- Hydrofluoric Acid, Anhydrous
- Isopropyl Acetate
- Ketones: Methyl-Ethyl, Methyl-Isobutyl
- Lithium Chemicals
- Maleic Acid and Anhydride
- Mannitol
- *Monoethanolamine
- Molybdenum Chemicals
- Naphthalene and Derivatives
- Nicotinic Acid and Derivatives
- Penicillin
- Pentaerythritol
- Perchlorethylene
- *Phenol and Derivatives
- Phosphate: *Tricresyl, Triphenyl
- Phosphorus
- Phthalate Plasticizers
- Phthalic Anhydride and Derivatives
- Potash Salts
- Pyridine
- Sodium Metasilicate
- Sodium Nitrate
- Sorbitol
- Sulfuric Acid
- Styrene
- Superphosphates
- Thiourea
- Tin Chemicals
- Toluol and Derivatives
- Urea
- Xylol

* Most critical.

D. LUMBER

- Ash
- Balsa
- Basswood
- Beech
- Birch
- Cottonwood
- Cypress: Common Boards, Boat, Box, Dimension, Tank
- Douglas-Fir: Aircraft Common Boards: 2" & thicker Clears; 2 x 4s & 2 x 6s Dimension
- Elm
- Gum
- Hackberry
- Hemlock: Eastern, Western: Aircraft; Common Boards; Box; Ladder; 2 x 4s & 2 x 6s Dimension
- Hickory
- Larch, Western: Common Boards
- Lignum-vitae.
- Magnolia
- Mahogany
- Maple
- Oak
- Pecan
- Pine, Norway, Ponderosa: Common Boards; Box; Inch Shop; No. 2 & No. 3 Shop. Southern: Common Boards; Box; 2 x 4s and 2x 6s Dimension. Sugar: Common Boards Box; Inch Shop; No. 2 & No. 3 Shop. White: Eastern, Western: Common Boards; Box; Inch Shop; No. 2 & No. 3 Shop
- Poplar, Yellow
- Rattan
- Redwood; Common Boards; Tank & Pipe
- Spruce: Eastern. Sitka: Aircraft; Common Boards; Box; Ladder
- Sycamore
- Tupelo
- Walnut
- Willow

E. TEXTILES AND FIBERS

- *Agave
- Alpaca
- Bristles: Pig and Hog: 3¼" and over Down
- Feathers: Goose and Duck, up to 4"
- *Heavy Hides
- Hemp: Fiber, Seed
- Kapok
- Leather: Except sheepskins
- *Manila
- Nylon
- Rayon: High Tenacity
- Silk: *Garnetted, *Noils and Waste, *Raw, Used and Reclaimed.

F. MISCELLANEOUS PRODUCTS

- Abietates
- *Agar
- Alkyd Resins
- Aluminum Oxide Abrasives
- Gasoline
- Glass: Fibrous
- Hardboard
- Mica: Good Stained and better grades
- *Quinine
- Refractories: Chromite, High Alumina, Silicon Carbide, High Grade

Asbestos Textiles
Bauxite: Low Silica
Cadmium Pigments
Carbon Black: Furnace
Casein
Charcoal
Coal Tar: High Flash Naphtha Solvent
Chrome Pigments
Container Board: Kraft
Corundum
Fluorspar: Metallurgical, Acid
Fuel Oil: East Coast and Pacific Northwest
Microcrystalline Wax
Natural Gas
Oils: Babassu, Cashew Nut Shell, Coconut, Linseed, *Oiticica, Palm Kernel, Rapeseed, *Sperm, *Tung
Plywood: Restricted Binder (*Birch, Douglas-Fir). Unrestricted Binder (Douglas-Fir, Ponderosa Pine)
*Pyrethrum
Quartz Crystals
Quinacrine Hydrochloride (Atabrine)
*Quinidine
Rosin: Stabilized
Rotenone
Rubber: *Crude and Latex, Chlorinated. Synthetics, Special Purpose: Oil Resistant Types. General Purpose: GR-X
Silicon Carbide Abrasives
Talc: Indian Block
Vegetable Tanning Materials
Vinyl Resins
Vulcanized Fiber
Wool Grease (Lanolin)
Zein
Zinc Chromate

Group II

These materials, essential to the war program enjoy supplies at present *sufficient* to meet war demands plus essential industrial demands under existing administrative control.

In Group II the order of listing within each subgroup indicates relative criticalness only under *A. METALS*, and *B. PLASTICS*. These lists follow the corresponding sections in Group I.

A. METALS

(See italics under "Changes")

a—Metals:
Zinc
Aluminum (Controlled Material)
Silver
Magnesium
b—Ferro Alloys:
Molybdenum
Silicon Metal
Ferrochromium
Ferro Tungsten
Ferro Vanadium
Spiegeleisen
c—Basic Irons:
Alloy Cast Iron
Wrought Iron
Gray Cast Iron
Pig Iron: except Low Phosphorus
d—Steel Construction Materials:
Structural Shapes
Piling
Wire Mesh Reinforcing
Reinforcing Bars
Rerolled Rail Products

B. PLASTICS

a—Thermoplastic:
Copolymers of Vinyl Acetate and Vinyl Chloride
Polyvinyl Acetate
Polyvinyl Butyral
Polyvinyl Formal
Polyvinyl Chloride
Cellulose Acetate
Polyvinyl Alcohol
Methyl Methacrylate
b—Thermosetting:
Melamine Aldehyde Plastics
Urea Formaldehyde
Phenolic Laminates
Phenolic Molding Materials
C—Miscellaneous:
Vulcanized Fiber: Under 0.030" gage

C. CHEMICALS

Acetylene Black
Alcohol: Ethyl, Isopropyl
Alums
Aluminum Chloride: Anhydrous
Aluminum Chemicals: except those in Group I
Ammonia and Derivatives
Amyl Chloride
Antimony Chemicals
Bleaching Powder
Bismuth Chemicals
Borax
Bromine
Calcium Carbide
Cerium Salts
Chlorates and Perchlorates
Chlorinated Hydrocarbon Solvents: except those in Group I.
Chlorinated Waxes
Chlorine
Chromium Chemicals
Citric Acid
Copper Chemicals
Ethers: except those in Group I
Furfural
Gelatines
Glycerol
Glycols
Hydrogen Chloride: Anhydrous
Iodine
Ketones: except those in Group I
Lactic Acid and Lactates
Lithopone
Magnesium Chemicals
Manganese Chloride: Anhydrous
Naphthenic Acid and Derivatives
Nickel Chemicals
Nitric Acid
Phosphorus: Oxychloride, Pentoxide
Potassium Permanganate
Rare Earth Salts
Silica Gel
Silver Chemicals
Sodium Phosphates
Soybean Proteins (including Alpha Protein)
Strontium Chemicals
Zinc Chemicals
Zinc Oxide
Zirconium Salts

D. LUMBER

Cedar, Red, Western: Common Boards; Box; Clears; Dimension
Clears; Ceiling; Flooring; Drop Siding; Shop; 2 x 8s & wider Dimension
ing; Drop Siding; Shop; 2 x 8s & wider Dimension. Sugar, B & better; C; D; No.
Cypress: FAS; Selects; Shop
Douglas-Fir: 1" Clears; Ceiling; Flooring; Drop Siding; Shop; 2 x 8s & wider Dimension
Hemlock, Western: 1"
Larch, Western: C & better; D; 2" Dimension
Pine: Ponderosa: B & better; C; D; No. 3 Clear; No. 1 Shop. Southern: B & better; C; D; Ceiling; Floor-
3 Clear; No. 1 Shop. White, Western: B & Better; C; D; No. 3 Clear; No. 1 Shop.
Redwood: A; B; Dimension; Shop
Spruce, Sitka: Dimension; Shop

E. TEXTILES AND FIBERS

Coir
Cotton: Duck, Long Staple
Flax: except Seed Tow
Goatskins
Hair: Horse Tail and Mane, Cattle Tail
Jute: Burlap, Fiber
Istle
Rayon: Filament, Staple Fiber
Sunn Hemp

F. MISCELLANEOUS PRODUCTS

Acrylic Resins
Albumin: Blood
Aluminum Pigments
Boxboard; set-up and folding
Caffeine
Cellophane
China Clay: English
Cohune Nuts and Kernels
Coal and Coke
Coke: Petroleum
Concrete: Reinforced Products
Container Board: Jute
Cotton: Chemical Pulp, Linters
Cryolite
Diamonds: Industrial
Ester Gums
Fiberboard: Laminated
Glass: Optical
Glues: Animal, Vegetable
Graphite: Lump
Melamine Resins
Mica: except grades in Group I
Molasses
Oils: Castor, Corn, Cottonseed, Fish, Fish Liver, Neatsfoot, Palm, Peanut, Soybean, Sunflower, Tall, Vitamin "A"
Paper and Products
Petroleum Products: Crude Oil, Lubricating Oil: Heavy Duty Penn Grade
Phenol-Formaldehyde Resins
Plywood: Unrestricted Binder (Hard Maple)
Sweet Gum
Refractories: Insulating Brick, Kyanite, Sillimanite
Rosin: Light Colored Grades
Rubber, Synthetic: General Purpose: G. R.-S., G. R.-P., G. R.-M.
Rubber: Reclaimed
Rutile
Shellac
Spodumene
Starch: Domestic
Theobromine
Titanium Pigments
Urea Formaldehyde Resins
Vinsol
Waxes: Bees, Carnauba, Ouricury, Vegetable
Wood Pulp: inc. Alpha Cellulose

Group III

These materials are *available* for *essential* uses. They should be substituted for the scarcer materials in Groups I and II wherever possible unless supplies are restricted locally by labor, manufacturing or transportation difficulties.

Throughout Group III all subgroup items are listed alphabetically, except *PLASTICS*, which are in order of criticalness.

A. METALS

a—Metals:
Antimony
Calcium
Gold
Lead
Mercury
Palladium
b—Ferro Alloys:
Cobalt
Ferroboron
Ferromanganese
Ferrosilicon
Ferrotitanium
Silicomanganese
Silvery Iron
Zirconium Ferro Alloys

B. PLASTICS

Lignin
Cellulose Nitrate

C. CHEMICALS

Barium Chemicals: except Perchlorate
Camphor
Iron Oxide: Syn. Yellow
Lead Chemicals
Nicotine Sulfate
Salt Cake
Sodium Silicates: except Metasilicate
Sodium Silicofluoride

D. LUMBER

Cedar, Red, Western: Timbers
Cypress: Peck; Timbers
Douglas Fir: Timbers; 3" & 4" Dimension
Hemlock, Western: Timbers; 3" & 4" Dimension
Larch, Western: Timbers; 3" & 4" Dimension
Pine, Southern: Timbers; 3" & 4" Dimension
Redwood: Timbers

E. TEXTILES AND FIBERS

Cotton: Short Staple
Flax: Seed Tow
Hair: Calf, Cattle, Goat
Sheepskins
Wool: New, Reprocessed, Reused

F. MISCELLANEOUS PRODUCTS

Asbestos: Cement Sheets, Short Fiber
Asphalt
Bauxite: High Silica
Bentonite
Board: Asphalt laminated
Brick
Carbon Black: except Furnace
Cement: Portland
Ceramics
Coal Tar: Pitch
Concrete: Nonreinforced Products
Cork
Diatomite
Emery
Feldspar
Flint
Fuller's Earth
Garnet
Glass: except Fibrous and Optical
Graphite: Amorphous
Gypsum and Products
Insulation Board: Granule Surface, Structural
Lead Pigments
Lime
Magnesium Oxide
Mercury Pigments and Chemicals
Mineral Wool
Petroleum Products: Aliphatic Naphthas, Lubricating Oil: except Penn Grade
Pottery
Pyrophyllite
Pyroxalin
Refractories: Dolomite, Fire Clay, Magnesite, Olivine, Silica
Resin: Accroides, Congo Copal, Kauri
Rosins: except those in Groups I and II
Salt
Silica Sand
Stone: Granite, Limestone, Marble, Slate
Soapstone
Straw
Sulfur
Talc: Ground, including Steatite
Tanning Materials: except vegetable
Tile
Tripoli
Turpentine
Vermiculite: common sizes
Whiting
Wood Products: Sawdust, Wood Fiber, Wood Flour

Regarding suggestions and extra copies address: WPB, Conservation Division, Washington Gas Light Building, 11th and H Streets, N.W., Washington 25, D. C.

Treatment of Experimental Data[1]

A RECENTLY published book, "Treatment of Experimental Data"[2] by Archie G. Worthing and Joseph Geffner, brings together under one cover a helpful collection of procedures and methods that are commonly used in the handling and evaluation of experimental data.

Perhaps one can best appreciate the general character of the material presented in this book by noting the climate in which it was written, as indicated in the preface:

"This book is in part a consequence of a long series of irritations on the part of the senior author. During the course of years he encountered too often tables of unsmoothed values, tables without descriptive legends or with inadequate legends, graphs with poorly chosen coordinate scales, . . . lack of understanding of how to determine, to express, and to apply precision indexes, blind faith in a least squares computation regardless of the assumptions and limitations, and many other faults which may be remedied with reasonable effort. For several years this author has offered a course for graduate students . . . in which such matters among others have been discussed. The present textbook is an outgrowth of that course."

The book thus deals primarily with the problems of the physicist, the chemist, and the engineer seeking to discover the magnitude of physical constants, the functional or empirical relationship between two or more variables, etc., from data obtained in the development or research laboratory. His measurements can never be exact but are subject to errors and uncertainties which need to be carefully handled if the essential information is to be transmitted to others.

The first three chapters deal with the representation of data by tables, graphs, and equations. A particularly helpful collection of procedures and practices relating to smoothing and tabulating, significant figures, rounding off numbers, and interpolation are given in the chapter on tables. The tables presented throughout the text indicate that the authors firmly believe in practicing what they preach. The information on graphs includes a brief discussion of the general principles of graphical presentation, and reference to the several standards published by the American Standards Association would seem to have been in order. However, the authors' primary purpose is to discuss and offer specific recommendations for graphs prepared for use as tools or graphic aids in discovering underlying laws of relationship between variables, in obtaining empirical curves that will best fit given sets of data, or in providing curves on a divided scale that will enable others to read numerical values to a desired degree of fineness. As the authors indicate, the rules to be followed in individual instances depend upon the purpose of the graph. For example, the suggested relationship between the spacing of coordinate rulings of the graph and the uncertainties of measurement may be desirable for a graph used as a tool but hardly so for the majority of engineering and scientific graphs prepared as originals for publication.

Various methods of fitting an equation to a set of data are given and are clearly illustrated by well-chosen examples. The authors stress, and quite advisedly, the convenience and time saved by the use of determinants in many treatments of data, and particular attention is given to their application in determining the equations of curves. A convenient digest of determinant methods is incuded in an appendix "recognizing that many users of this text may need to have their memories refreshed with regard to methods of use."

Methods of tabular and graphical differentiation and integration are covered in one chapter. Two chapters are assigned to analysis of harmonic and nonharmonic periodic functions, use of Fourier Series, procedures for evaluating series coefficients, etc.

Nearly half of the book deals with a group of subjects in the realm of statistics, subjects which practically every physicist and engineer runs into sooner or later and which many obdurately avoid: frequency distributions of errors of measurement, precision indexes, law of propagation of error, adjustment of conditioned observations, and least-squares equations for representing observed data. Many will be pleased to have this material, covering a wide range of conditions encountered in practice, collected together in one volume for ready reference. Those who have found that later developments are essential in their everyday work may wish that certain of these subjects had been pursued further and may be disappointed, for example, to have the subject of precision indexes treated with scant reference to pertinent developments of recent years in the field of mathematical statistics—confidence limits, testing hypothesis for errors of the first and second kinds, tolerance limits, etc. In dealing with practical problems it is desirable to take these matters into account and it is hoped that the next edition will be expanded in this direction.

Finally, there are appended a number of tables useful in performing various operations called for in the text, including such items as normal law probabilities, chi-square, constants entering least square solutions, logarithms and square roots.

Although the discussions are necessarily mathematical, the authors have been successful in keeping physical situations to the forefront throughout the book.

[1] Reviewed by H. F. Dodge, Chairman, A.S.T.M. Technical Committee IX, of E-1, on Interpretation and Presentation of Data.

[2] *Treatment of Experimental Data*, by Archie G. Worthing and Joseph Geffner, John Wiley & Sons, Inc. New York 16, 1943. Cloth 6 by 9 in., 342 pp., $4.50.

XXXIV. Long-Time Society Committee Members

Thirty-fourth in the Series of Notes on Long-Time Members

As a continuation of the series of articles in the ASTM BULLETIN comprising notes on the outstanding activities of long-time A.S.T.M. members, there are presented below outlines of the work of three additional members. In general, the men whose activities are described in this series have been affiliated with the Society for 25 years or more and have taken part in committee work for long periods of time. No definite sequence is being followed in these articles.

H. P. Hass T. A. Hicks F. C. Elder

FLINT C. ELDER, Special Research Engineer, American Steel and Wire Co., Cleveland, Ohio, has spent his entire career since graduating from college with this company, a U. S. Steel subsidiary. Mr. Elder was educated in the public schools at Malden, Mass., and attended Massachusetts Institute of Technology and Columbia University of Mines, where he obtained his Metallurgical Engineer's degree. His first employment with American Steel and Wire was in January, 1911, as an assistant in the physical laboratory at South Works, Worcester, Mass. Transferred to Cleveland, he was appointed chief of the physical laboratory at the company's Newburgh Wire Works in January, 1917, and rendered invaluable service all during World War I by testing shell steel going into ammunition for our armed forces. In March, 1919, he was transferred to Pittsburgh as Metallurgist, and seven years later was again moved to Cleveland in the same capacity. In January, 1934, Mr. Elder was named Chief Metallurgist of the company and the following month was made Director of Research. He was appointed to his present position in March, 1942.

Mr. Elder had the honor to be selected by the directors of the Wire Association to deliver the 1943 Mordica Memorial Lecture, a paper presented annually in honor of the memory of John Mordica, the first president of the Association. Mr. Elder chose as his subject "The Wire Drawing Die" and presented an outstanding lecture in Chicago on October 20.

Mr. Elder has been a member of the Society since 1910, and was for a number of years affiliated with Committee A-1 on Steel. He is at present serving on Committee A-5 on Corrosion of Iron and Steel, and is chairman of this group's Section on Telephone and Telegraph Line Wire, and is a member of Committee B-2 on Non-Ferrous Metals and Alloys. He was formerly a member of the Sectional Committee on Zinc and Zinc Ores functioning under the American Standards Association, and also served on the A.S.T.M. Cleveland District Committee for a period.

H. P. HASS, Engineer of Tests, The New York, New Haven and Hartford Railroad Co., New Haven, Conn., was graduated from Yale University, Sheffield Scientific School in 1907 with the degree of Ph.B. in Mechanical Engineering. Upon graduation he entered the locomotive shops at New Haven, as a Special Apprentice, and his entire business career has been with the New Haven Railroad.

In addition to the usual duties of the position of Engineer of Tests, he has under his direction the maintenance inspection of steam and electric locomotives and marine equipment; the shop and terminal maintenance and inspection standards and practices pertaining to boilers, auxiliaries and devices on locomotives; the inspection and maintenance of locomotive lighting and train control; the standards and practices on oxyacetylene and electric arc welding in the Mechanical Department. He also has under his direction the Apprentice Training Plan in the Mechanical Department.

His membership in A.S.T.M. dates from 1919, and he is a member of Committees A-1 on Steel, A-2 on Wrought Iron, and D-11 on Rubber Products. He also served on Committee A-7 on Malleable-Iron Castings from 1938 to 1941.

Mr. Hass is the author of several papers on maintenance of steam locomotives. He is a member of the Board of Governors of New Haven Y.M.C.A. Junior College. Serving as a member of the Committee on Specifications for Materials of the Association of American Railroads, he is chairman of the committees concerned with rubber products, the conservation of rubber, and of tin, and serves on the committee on reclamation of materials.

THOMAS A. HICKS, General Chemist, Universal Atlas Cement Co., New York, N. Y., retired from active service August 31, 1943, after more than 45 years of service in the cement industry. Mr. Hicks graduated in chemistry from the Case School of Applied Science in 1896 and became Chief Chemist, of the Art Portland Cement Co. at Ransoms, near Sandusky, Ohio, in 1897, and of the Whitehall Portland Cement Co. at Cementon, Pa., in 1900. He began his service with the Atlas Portland Cement Co. as Chief Chemist at its Northampton, Pa., plant in 1904, Chief Chemist for the Atlas Co. in 1916 and for the Universal Atlas Co. in 1930.

Mr. Hicks was in charge of the original investigations on the development of Atlas White and Atlas Lumnite cements, and closely associated with the original manufacture of Unaflo oil-well cement, Atlas High-Early Strength Cement, and the various types of modified cements. He has seen the amount of cement tested under his supervision rise from 150 bbl. per day to 30,000 bbl. per day in a single plant—a total during his almost 40 years' supervision of testing of nearly half a billion barrels. This included the manufacture of all cement originally used for the Panama Canal, shipments for which at the peak reached 7500 bbl.

a day. At one time the National Bureau of Standards had 32 men at the Northampton, Pa., plant with as many as 350,000 barrels represented in tests under way at one time. In all, over eight million barrels were shipped to Panama without the rejection of a single barrel.

Mr. Hicks has participated in the progress and development of the company's plants, including the original operations at some of them and including the prospecting in 1909 at the Hudson, N. Y., plant where he also installed the first laboratory. Since then, he equipped and assisted in the designing of the laboratories built at Waco, Tex.; Leeds, Ala.; Hudson, N. Y.; and Northampton, Pa.

Mr. Hicks has been a member of the Society since 1914, serving on Committee C-1 on Cement from that date, and on Committee C-11 on Gypsum since its inception in 1915. He was also a member of Committee D-13 on Textile Materials for several years, and was one of three members that drew up the original specifications for Osnaburg Sacks.

"Why Specifications?"

THIS QUESTION, "Why Specifications?" is the subject of an interesting article appearing in October, 1943, *Civil Engineering*, the monthly journal of the American Society of Civil Engineers, and is one of "A Series of Reflective Comments Sponsored by the Committee on Publications," issued under a main heading of "Something to Think About." Many of these articles have been of much interest to all engineers, whether or not they are concerned with civil engineering.

In the discussion of specifications Mr. Rolf T. Retz, Civil Engineer, U. S. Engineers, War Dept., Jacksonville, Fla., points out that while the question may seem silly, nevertheless, a number of people, including some engineers, but particularly contractors consider the question a serious one, and that frequently construction specifications (which are the kind Mr. Retz has chiefly in mind) are looked on as unnecessary evils and perhaps may be thought of as just so much red tape.

Do we encourage red tape? Engineers are supposed to eliminate this, but actually "many specifications can be reduced 50 or even 70 per cent in length without losing any of their essentials—the elements needed by a bidder to submit an intelligent bid." They may be too complicated and confusing and result in much waste of time and effort.

Then, there is the over-fussy kind of specifications which give in detail every screw, daub of paint, and tiny piece of equipment. Mr. Retz writes

"... field processes and construction procedures should generally be included in detail, unless result or performance requirements can be specified. The latter is always preferable. . . .

"Such practice is so much more deplorable because it is so easily rectified by reference to applicable standard specifications. A wonderful tool is at hand in the documents of a number of national organizations, such as the American Society for Testing Materials, the American Standards Association, the American Institute of Steel Construction, and others. Construction specifications should, in general, refer to these standards for materials, manufacturing processes and test methods, and also for the more standardized field processes, such as welding and steel erection.

"... many specifications are full of ambiguities. The most common example of an ambiguous phrase is, 'as directed by the engineer.' Many small concerns dare not bid on work with this kind of specification. . . ."

Where does the responsibility for confusing, red tapish or over-fussy and ambiguous specifications lie? . . . according to the writer, "solely with the engineering profession, and both government and private engineers must take the blame. . . . There is absolutely no excuse for tolerating any red tape in engineering specifications. If they are to serve their purpose, they can be and must be simple." He goes on—"One may wonder why it is not possible to obtain the same degree of excellence in writing specifications as in making drawings. But how many draftsmen and designers have had a corresponding training in writing specifications? Very few indeed. . . . Training should be provided for those who do the work. Specifications writing is no drudgery. The specification writer must know English and how to express himself. He must be familiar with materials, and with manufacturing and construction practices, and must know the various national standardization organizations and their publications."

We Need Adequate Inspection. . . . Since good specifications alone will not guarantee that the owner gets what he wants, what is the answer? ... it is adequate inspection....

"Any engineering organization that neglects to provide for adequate and competent inspection is only fooling itself. Such inspection is just as important as well-prepared design, drawings, and specifications.

"Accordingly, besides training its specification writers, a progressive engineering organization will also train inspectors of materials, equipment, and construction. These two fields—specifications and inspection—are complementary. One without the other is like a one-legged man. Together they form the basis for good engineering works."

We shall merely add—Amen!

S.I.Q.S.—?

WHAT IS IT? . . . It is the Society of Industrial Quality Statisticians, which Frank T. Sisco in a news note in the October issue of *Mining and Metallurgy* describes as a healthy infant. Organized in 1941 it has held several meetings and is established as a forum for those concerned with industrial applications of statistics. Considerable work has been done and is under way in connection with interpretation of data and the control of quality, and in some countries, with Australia among the leaders, there is very pronounced interest in the work and recognition of its practical values. Apparently S.I.Q.S. has recently become affiliated with the Institute of Mathematical Statistics, but the primary interest remains the same—promoting the use of statistical methods in solving certain industrial problems. One of the A.S.T.M. committees, Technical Committee IX on Interpretation and Presentation of Data, of Committee E-1, has done important work in this field and sponsored the Manual on Presentation of Data, one of the most widely distributed A.S.T.M. publications.

House Organ on Spectrography

MEMBERS AND committee people concerned with spectrographic analysis may wish to avail themselves of the offer from Harry W. Dietert Co., 9330 Roselawn Ave., Detroit 4, Mich., to have their name placed on the company's mailing list to receive a bimonthly house organ which will include technical information and news notes of interest to spectrographers and those concerned with this field.

Tyler Davidson Fountain with Carew Tower in Background

(See article on Cincinnati Meeting, page 11)

January '41, '43 Bulletins Requested

MEMBERS AND others who may have in their files copies of the January BULLETINS for the years 1941 and 1943, and who feel that they can dispense with one or more of these issues will be rendering a service if they will return them to A.S.T.M. Headquarters, because the stocks of these particular numbers are very low brought about by demands occasioned in part by the policy of furnishing to new members who join throughout the year back copies of the BULLETINS for the respective years. The Society will be glad to purchase the copies for 25 cents each.

What's in a Name?

The following is from the October *U.S.I. Chemical News:*

Four different spellings of "Atebrin" currently appear in the literature about this new anti-malarial. "Atebrin" say both the American and British *Chemical Abstracts.* "Atebrine" says *Thorpe's Dictionary of Applied Chemistry.* "Atabrin" says *The Merck Index.* "Atabrine" says the *United States Dispensary.* On top of this, chemists call it quinacrine hydrochloride—or 4 amino-1-diethyl amino pentane 3-chloro-7-methoxyacridone, for *short!*

Schedule of A.S.T.M. Meetings

DATE		PLACE
December 9	Detroit District (Sym. on Corrosion)	Hotel Statler, Detroit, Mich.
December 16	Philadelphia District (Problem of Critical Instability)	Franklin Institute, Philadelphia, Pa.
January 17, 18	Executive Committee	Headquarters, Philadelphia, Pa.
January 17, 18	D-2 on Petroleum Products and Lubricants	Statler Hotel, Detroit, Mich.
February 21, 22	D-9 on Electrical Insulating Materials	Hotel Warwick, Philadelphia, Pa.
February 22, 23	Philadelphia District (Sym. on Plastics)	Hotel Warwick, Philadelphia, Pa.
February 23, 24	D-20 on Plastics	Hotel Warwick, Philadelphia, Pa.
February 28–March 3	SPRING MEETING AND COMMITTEE WEEK	Netherland Plaza, Cincinnati, Ohio

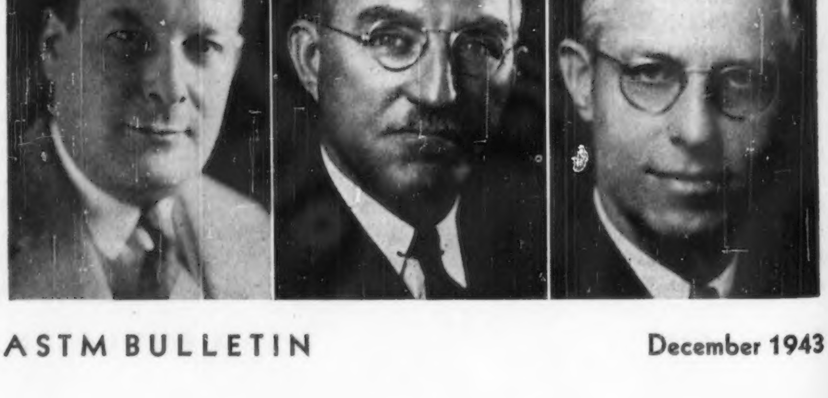
Abstracts of Alien Patents

THE CHEMICAL patents and patent applications vested by the Alien Property Custodian have been abstracted by the Chicago Section, American Chemical Society and indexed by a committee of the Science and Technology Group, Special Libraries Association. Beginning in January, 1944, these abstracts will be published in 31 classified, indexed pamphlets, to be followed by a master index and a supplement of new abstracts. The prices, if demand is adequate to justify them, will be $1.00 for any booklet and $25.00 for all 33 booklets. Many libraries will want a reference copy and a circulating copy. Orders should be placed promptly to make sure of receiving copies. Order blanks (already sent to all A.C.S. members) may be had from the Alien Property Custodian, Field Bldg., Chicato 3, Ill.

A Bit of Humor

Beware the deadly sitting habit,
Or, if you sit, be like the rabbit,
Who keepeth ever on the jump
By springs concealed beneath his rump.
A little ginger 'neath the tail
Will oft for lack of brain avail;
Eschew the dull and slothful seat,
And move about with willing feet.
Man was not made to sit a-trance
And press, and press, and press his pants;
But rather, with an open mind,
To circulate among his kind.
And so, my son, avoid the snare
That lurks within a cushioned chair;
Both feet betimes, must hit the ground.
To run like hell, it has been found,

—From *Cleveland Engineering*



Officers of New Standing Committee on Aromatic Hydrocarbons (see p. 35), left to right: J. M. Weiss, *chairman;* A. C. Lunn, *vice-chairman,* and R. P. Anderson, *secretary.*

A.S.T.M. Research

(Continued from page 8)

with draft of specifications for alloy castings nearing completion. Another study concerns magnetic permeability test as a criterion of creep strength.

Test for Thermostatic Metals (Committee B-4, Sub. VII).—In 1940 methods of testing thermostat metals (B 106) were adopted. Studies of methods for determining elastic properties continuing and data on bend test being obtained, the latter to be considered in connection with determining the temper of the metal. Interlaboratory tests will be carried out on an extensive scale to evaluate a proposed method of measurement of equivalent yield stress for thermostat metals, see 1943 B-4 Report. 1942 compilation of B-4 standards includes a specially prepared technical paper on "Thermostat Metal" by S. R. Hood; also paper by W. F. Roeser and H. T. Wensel, National Bureau of Standards on "Methods of Testing Thermocouples and Thermocouple Materials," originally published in the National Bureau of Standards *Journal of Research*, Volume 14, March, 1935, as Research Paper RP768.

Materials for Radio Tubes and Incandescent Lamps (Committee B-4, Sub. VIII).—Original program was to cover strip, wire tubing, coated material, powdered material, and liquids. Tests for nickel alloy wire and ribbon for filaments (B 118) issued in 1939 and for sleeves and tubing for radio tube cathodes (B 128), in 1940. Also, tests covering lateral wire for grids of electronic devices (B 156) issued in 1941. Other standards cover temper of strip and sheet metals (B 155), new tests for density of fine wire and ribbon (B 180), and specifications covering nickel wire (B 175), issued in 1942.

Studies of tungsten wire continuing, including experiments with electrolytic polishing of swaged rod. Studies of surface flaws under way and method to determine uniformity of helical coils discussed—this probably ties in with detection of surface flaws.

Tests for Materials for Contacts (Committee B-4, Sub. X).—Based on preliminary life tests with two different machines, a design was agreed on and several testing machines manufactured for use in some twelve laboratories cooperating. Nine laboratories later carried out tests with different values of closing and opening forces and test for load-carrying capacity. Method of Life Test of Electrical Contact Materials approved as tentative in 1943 (B 182). Further work is under way. Two significant technical papers published in 1942 compilation of B-4 standards, first by Messrs. Holt and Graves on "Electrical Surge Tests on Contact Materials," second by Suggs on "An Electrical Contact Testing Machine," latter also published in December, 1942, Bulletin

A very valuable publication for those concerned is now in preparation comprising an abstract bibliography of some 800 references to articles on contact materials, publication date December, 28, 1943.

Copper, Die Casting, Aluminum and Magnesium

Tests for Copper and Copper Alloys (Committee B-5, Subs. I, X, XI, etc.).—Based on rather extensive laboratory work, tests for mercurous nitrate (B 154) and expansion (pin test) (B 95) were issued in 1941. Two technical papers in 1941 *Proc.* describe applications of mercurous nitrate and mercury cracking test.

In work on copper-zinc sheet and strip, round-robin studies on grain size are under way. In another branch of the work, copper-base alloys for sand castings, an extensive and interesting study was described in a paper by Messrs. A. J. Smith and J. W. Bolton on "Effects of Sulfur and Antimony on Steam or Valve Bronze Castings"—see May, 1942, Bulletin. Another extensive report involving machined *versus* as-cast test specimens includes pertinent data on this question of test bar practice. For report see 1942 *Proc.*

Investigation of Aluminum-, Zinc-, and Magnesium-Base Die-Casting Alloys (Committee B-6, Subs. I, II, VII).—Purpose of various investigations beginning in 1930 is to supply dependable information on the properties of alloys suitable for die castings and the formulation of specifications based either on the alloys tested or on alloys developed as a result of the investigation. Several important specifications and emergency provisions have been issued, see Book of Standards and List of Emergency Alternate Provisions.

Reports of Committee B-6 in *Proc.*, Vols. 32, 34 and 35 give data on results of outdoor exposure tests at various test locations and also from indoor tests involving aluminum-base die-casting alloys and zinc-base alloys. Data include chemical analysis, physical tests—tension, impact, expansion and photographic exhibits. 1936 Report gives results on high-purity aluminum alloy castings after accelerated tests. Corrosion program expanded later to include magnesium-base alloys. *Proc.*, Vols. 37, 39, and 40 have pertinent information on these various tests. Significant papers include one by J. C. Fox on "Finishing of Die Castings," 1936 *Proc.*; G. L. Werley on "Improvement of the Soundness and Uniformity of Test Bars," 1937 *Proc.*; and A. W. Winston on "Magnesium Alloy Die Castings," 1939 *Proc.*

New program to cover proposed alloys which have 8 per cent magnesium, remainder aluminum; the other aluminum alloy with 9 per cent silicon, 0.5 per cent magnesium. To include tension tests, accelerated and normal aging tests. Emergency alternate provision to conserve aluminum, EA-B 85a. Paper by E. H. Kelton covers fatigue testing of zinc-alloy die castings—see 1943 B-6 Report.

Investigation of Tin- and Lead-Base Die-Castings Alloys (Committee B-6, Sub. III).—A study of 5 tin- and lead-base alloys to determine tensile strength, creep, impact, and hardness. Composition of the alloys determined by chemical and spectrographic analyses (1937 *Proc.*). For results of preliminary tests see 1939 *Proc.* Creep tests under way, report not yet presented. Work temporarily in abeyance because there was scarcity of lead and tin.

Anodic Oxidation of Aluminum and Aluminum Alloys (Committee B-7, Sub. VI).—For data accumulated by committee covering methods of testing oxide coatings on aluminum, see 1937 *Proc.* Later (1940) certain tests issued as standard covering dielectric test for sealing (B 136) and weight of coating (B 137). 1940 *Proc.* include four technical papers on anodic coatings covering thickness, abrasion resistance, electrical breakdown and use of the microscope. Recently tests to compare the performance of anodic coatings in the salt spray (B 117) with behavior under atmospheric conditions have been started by four laboratories as described in the 1943 Report. A preliminary statement is of interest. The results, generally speaking, indicate that while salt spray exposure tests may discover coatings subject to early failure, still the resistance of most anodic coatings to this type of exposure is sufficiently extended so that the method could scarcely be considered an accelerated test. Atmospheric exposures are under way in Philadelphia; Chicago; New Kensington; Miami; Point Judith, R. I.; and Oakland, Calif. Investigations of relative corrosion resistance of anodic coatings on casting alloys may be undertaken.

Minor Alloying Elements in Aluminum-Casting Alloys (Committee B-7, Sub. II).—Studies under way to develop information on effects of impurities or stray alloying elements in commercial aluminum alloy castings covered by A.S.T.M. specifications. Notable development is a technical paper by Walter Bonsack, National Smelting Co., member of the committee, which won for him the 1943 Dudley Medal award. It deals with both physical and corrosion-resistant properties, considering castability, machinability, heat treatment, and stability at elevated, subnormal, and room temperatures. Concrete conclusions are drawn as to whether various amounts of different alloying elements are beneficial or harmful, or possibly neutral, and how they affect the desired properties. These conclusions should have a definite economic value in furthering a better utilization of available aluminum supplies, including a more intelligent use of remelted aluminum alloys. Part II of this report dealing primarily with aluminum-copper-silicon alloys published in October, 1943, Bulletin. Important part of 1942 paper was very extensive bibliography.

Investigations of Electrodeposited Coatings (Committee

B-8).—Extensive outdoor exposure tests of electroplated coatings on various metals as carried out by certain A.S.T.M. committees and Joint Committee sponsored by the American Electro-Platers Society and A.S.T.M. detailed in various issues of the *Proceedings*. New committee on electrodeposited metallic coatings organized in 1941; several specifications issued. Current activities including exposure tests to clarify question of whether thin copper undercoatings are desirable with lead coatings. Committee hopes to get suitable lead plated panels for exposure. Plans under way to evaluate supplementary eutectic finishes. Another phase of work involves the development of satisfactory methods for detecting porosity.

For results of exposure tests of coatings on hardware, shapes, etc., see reports of Committee A-5, 1935, 1936, 1938 *Proc.* Latest report expected in 1944. For complete details of extensive exposure tests of plating on non-ferrous metals as carried out by Joint Committee see 1936 *Proc.*, and for summary of conclusions including a few tests on steel, see 1939 *Proc.*

Ferrous and Non-Ferrous Subjects

Effect of Temperature on the Properties of Metals (Joint Research Committee of A.S.M.E. and A.S.T.M.).—The scope of these investigations includes (1) an accumulation of service data on various metals under high and low temperatures; (2) studies leading to standardization procedure for testing metals at high and low temperatures; and (3) outlining and fostering new research work in this field, giving consideration first to the various metals and alloys intended for high-temperature service in power stations, oil refineries, etc. Numerous technical reports and papers have been published under sponsorship of committee in *Proceedings*. Almost every year there is one or more pertinent technical contributions in this field.

Three very notable publication efforts by the committee and its members included (1) the 1931 Symposium on Effect of Temperature on the Properties of Metals, a 829-page book which proved of unestimable service to all those concerned with the use of metals, primarily at elevated but also at subatmospheric temperatures; (2) the Volume on Creep Data (published in 1938) which gives in the form of charts, tables, and graphs the very extensive data developed by the committee covering large numbers of steels, nonferrous metals, and other metallic materials used at high temperatures; (3) the very pertinent report, "Impact Resistance and Tensile Properties of Metals at Subatmospheric Temperatures," a compilation of data from various sources which cooperated with the subcommittee, these data having been classified and supplemented by Dr. H. W. Gillett, with a large amount of material from the literature, principally foreign, added. Critical comments were supplied and a comprehensive bibliography on the subject was appended. Issued as a separate publication in August, 1941.

Current projects include study of tubular members subjected to internal pressures—see 1941 A.S.M.E. *Transactions* for technical paper. Another involves comparison of short-time test methods with thirteen laboratories cooperating with University of Michigan. It involves comparison of results from nine short-time test methods with those from long-time creep tests.

At suggestion of Joint Committee, War Metallurgy Committee has extensive research under way on impact properties particularly at low temperatures.

Several significant recent papers include one by Montgomery and Urban on "Structure and Creep Characteristics of Cast Carbon-Molybdenum Steel at 950 F."—see October, 1943, BULLETIN; others in 1943 *Proc.* involve "Interpretation of Creep-Test Data," McVetty; "Hyperbolic Sine Chart for Estimating Working Stresses of Alloys at Elevated Temperatures," Nadai and McVetty; and "Technical Cohesive Strength and Other Mechanical Properties of Metals at Low Temperatures," McAdam and Mebs; and others.

Fatigue of Metals (Research Committee).—The broad purpose is to summarize and correlate the work that various laboratories are doing and to study the relationship between fatigue failure and other strength properties of metals and their atomic and metallographic structure. Research projects carried out have resulted in numerous papers and reports published in *Proceedings*. Notable items relating to general field covered by committee include 1933 Edgar Marburg Lecture by H. J. Gough on "Crystalline Structure in Relation to Failure of Metals—Especially by Fatigue;" and in 1939, "Stress, Strain and Structural Damage," by H. F. Moore.

A report of investigation on the effect of type of testing machine on fatigue tests results is published in the 1941 *Proc.*, while 1942 and 1943 *Proc.* include first and second progress report on "Effect of Size of Specimen on Fatigue Strength of Three Types of Steel." Pertinent current papers, 1943 *Proc.* cover following: "Effect of Overstressing and Understressing in Fatigue," Kommers; "Fatigue Properties of Some Cold-Drawn Nickel Alloy Wires," Kenyon; and "Fatigue Tests on Some Copper Alloys in Wire Form," Burghoff and Blank.

Indentation Hardness and Hardness Conversion (Committee E-1).—Round-robin series of tests and an extensive survey of existing hardness test data on cartridge brass resulted in conversion tables, originally issued as emergency specification ES-4, now formal standard E 33–42. Next project was study of hardness conversion relations for steels in which SAE and ASM cooperated. Paper on Hardness Conversion Relationships (Heyer) covering following tests on variety of materials: Vickers 10 kg., 30 kg., and 50 kg., Rockwell "B" and "F," Rockwell Superficial 45-T, 30-T, and 15-T. Tentative hardness conversion table for steel issued August, 1943 (A 255). Current item of interest includes general symposium on Hardness Test of Metals, 1943 *Proc.*

Spectrographic Analysis and Applications (Committee E-2, Sub. III).—In 1942 tests were carried out on copper, nickel and their alloys involving chiefly methods for analysis of brass. In the field of lead, tin, antimony and their alloys, methods for spectrochemical analysis for impurities in lead and tin alloys issued E 49–43 T, E 51–43 T. Cooperative research tests showed good agreement between spectrographic and chemical analysis. Revision of standards covering zinc alloy die castings and spectrographic analysis of zinc, ES 26 and ES 27, resulted from round-robin tests. Additional studies are to cover analysis of cadmium and spark method for analysis of zinc. Technical papers presented at June, 1943, meeting, one entitled "Use of Photoelectric Spectrophotometric Techniques in Analysis," by Stillman, to be published in December, 1943, BULLETIN.

Radiographic Testing (Committee E-7).—Investigation and promotion of the application of radiographic testing of materials. Committee has concentrated work in developing technical papers. Two notable technical books issued—1936 Symposium on Radiography and X-ray Diffraction Methods first publication of its kind in the English language, secondly the May, 1943, Symposium on Radiography covering most recent developments in X-ray and radium inspection. Technical papers presented at June, 1943, meeting. Extensive one on "Estimating Radiographic Exposures for Multi-Thickness Specimens," by Seemann and Corney, published in August, 1943, BULLETIN.

Cementitious Materials ("C" Committee Group)

(On following page)

Cement

Particle Size and Specific Surface of Cement (Committee C-1).—Development and study of apparatus and procedures for determining subsieve gradation of particle-size and specific surface of cements. Early cooperative studies resulted in standard using turbidimeter (C 115). Various technical papers in *Proceedings* relating to turbidimeter and other methods of particle size determination. Most recent work concentrated on air permeability method with some ten laboratories cooperating. Method described in January, 1941, BULLETIN. This method is based on the time required for a definite volume of air to pass through a bed of powder. For two British discussions and latest paper by R. L. Blaine on "A Simplified Air Permeability Fineness Apparatus," see August, 1943, BULLETIN.

Chemical Analysis of Cement (Committee C-1).—Study of improved and shortened procedures. For report on work involving manganese and phosphorus in cement and procedures issued see 1937 *Proc.* For methods of determining manganic oxide and sodium oxide and potassium oxide and details of extended tests for determining free lime see October, 1938, BULLETIN and 1939 *Proc.* For details of tests for other chemistry elements and compounds see 1940 *Proc.* Some studies have involved use of Wagner turbidimeter and use of sulfuric anhydride and spectrographic methods. Latest studies in six laboratories have involved check methods for determining Vinsol resin.

Determination of Strength (Committee C-1).—Previous investigative work resulted in test for compressive strength of cement mortars (C 109). For tests of possibility of using concrete instead of mortar as an accepted test for cement, see 1936 and 1940 *Proc.* Statistical studies involving preparation of two-inch cubes covered in 1937 *Proc.* Latest work involves study of use of vibration during the molding of cubes, with five laboratories using five types of portland cement.

Time of Setting (Committee C-1).—Latest cooperative tests which involved paste and a 1:1 mortar would lead to proposed use of a 300-gr. 2-mm. needle as a basis for future study.

Sulfate Resistance of Cement (Committee C-I). This long-time and short-time test research is intended to aid in the development of physical tests indicative of sulfate resistance, and possibly in correlation of these tests with the chemical requirements of cement. 1940 *Proc.* give extensive paper by Messrs. Miller and Manson on sulfate resistance. Judged by results of the tests, authors concluded that a specified upper limit of 5 5 per cent of tricalcium aluminate might be a reasonable requirement for obtaining materials resistant to attack by magnesium and sodium sulfate.

Short-time tests carried out by six laboratories have been completed on 121 commercial cements. Following completion of this report a comparison will be made between short-time and long-time tests.

Additions to Cement (Committee C-1).—A study was completed in 1942 of one proposed addition when used in portland cements in highway paving concrete. A tentative specification for treated portland cement for highways resulted from this study (C 175). Studies of other additions, particularly some of the non-priority nature, will continue.

Bleeding, Plasticity, and Workability of Cement (Committee C-1).—Study of bleeding and workability of cement. Methods of preparing graded Ottawa cement mortar have been studied. Bleeding of portland cements also being investigated, and a bleeding test is under consideration. Copies of report distributed to members of Committee C-1.

Effect of Alkalies in Portland Cement.—1943 Report includes numerous prepared notes on the effect of alkalies on portland cement. Further discussion of the subject held at open meeting in Pittsburgh. A proposed standard procedure involving the mortar bar expansion test will be distributed to the committee for study, and various laboratories will evaluate the test. Following this a major test program is anticipated.

Fire Tests; Refractory Materials

Fire Tests of Acoustical and Similar Finishes (Committee C-5, Sub. IV).—Report submitted to subcommittee describing current work carried out by the National Bureau of Standards; tests having been conducted according to Federal specifications in various size tunnels. Discussion of flame-spread tests, tunnel tests, smoke tests, etc. Intensive work has been carried out at Underwriter's Laboratories and is being continued.

Size of Samples for Fire Test (Committee C-5, Sub. VII)—. Considerable work carried out at National Bureau of Standards and will be continued as opportunity is afforded. Current war problems must take precedence. Earlier information resulted in revision of the standard for fire tests of building construction and materials C 19.

Soundness of Lime (Committee C-7, Sub. IX).—For earlier discussions on this work see 1934 and 1938 *Proc.* Problem is to define term "soundness" and develop tests which properly measure soundness. Extensive questionnaire distributed and replies summarized. Committee will study definitions proposed. Generally the autoclave method for determining soundness was favored, and a method has been drafted to be applicable to finished hydrated lime and hydrated lime for masonry purposes. The subcommittee plans to accumulate data so that a proper limit on the expansion under the autoclave test can be set. Round-robin tests may be continued in an attempt to reduce the time required for the proposed methods.

Heat Transfer of Refractory Materials (Committee C-8, Sub. IV).—This committee has studied for a number of years methods for determining thermal conductivity of insulating fire brick for the purpose of evolving a method which would be as free as possible from error. Progress in this respect has been comparatively slow, so it was decided to make use of the best available method so as to obtain at least comparative values for thermal conductivity. The new method (C 182 – 43 T) involves heating the specimen with an electrically heated Globar type furnace and measuring the heat flow with an improved water calorimeter. In the past the committee has also provided a suggested procedure for calculating heat loss through furnace walls.

Panel Spalling Test of Refractories (Committee C-8, Sub. III).—Based on earlier research work involving vitrification with time, temperature, slag coatings, etc., various panel tests have been issued for determining resistance to thermal and structural spalling, including panel test for refractory brick (C 38), high heat duty fireclay brick (C 107), super duty fireclay brick (C 122), and fireclay plastic refractories (C 180). Later studies concerned revised design for the installation. Refractories Fellowship at Mellon Institute in cooperation with the section on spalling prepared a recommended practice for the panel spalling test which explained in considerable detail items which are not included in the present A.S.T.M. description of the test. Copies have been sent to five laboratories that use panel spalling furnaces, for the purpose of obtaining their suggestions.

The committee had planned to prepare a review of literature on the subject of thermal shock resistance of silica brick before undertaking any laboratory work for the development of a test procedure. One test had been discussed at a committee meeting in 1942.

Slagging of Refractories (Committee C-8, Sub. III).—While little actual research work is being carried out on this subject, the Refractories Fellowship at Mellon Institute prepared a review of the literature, which was published in the July, 1942, *Journal* of the American Ceramic Society, bringing up to date the last report issued in 1932.

Chemical Analysis of Refractories (Committee C-8, Sub. III).—Cooperative studies have been under way involving a method for determining ferrous iron in chrome refractory materials as proposed by Dr. G. E. Seil of E. J. Lavino and Co. This was

effected after several years of study and described in a paper published in March 15, 1943, *Industrial and Engineering Chemistry*, Analytical Edition. Reports indicate good agreement in the results from two laboratories.

Consistency and Plasticity of Refractories (Committee C-8, Sub. III).—In order to gain a fuller knowledge of plasticity and consistency of fireclay bodies, a study is being carried out on the correlation of yield value and mobility determinations. To develop needed information in connection with measuring plasticity in cold-set mortars, a Bingham plastometer was constructed at the Missouri School of Mines. Items of direct relation to the committee's work involve a review of the literature on the subject of viscosity, plasticity, and consistency. A paper on "Control Testing for Consistency of Refractory Mortars" by E. C. Petrie and D. W. Kocher, was published in the November, 1942, issue of the *Journal* of the American Ceramic Society.

Concrete and Aggregates

Methods, Including Field Tests, and Apparatus for Testing Concrete (Committee C-9, Sub. VII).—Several standard test methods issued in previous years based on investigative work including the flow table method (C 124), making and storing compression specimens (C 31), securing samples of hardened concrete (C 42), etc. More recent methods issued in 1942 cover sampling of fresh concrete (C 172), test for air content (C 173), and length of drilled concrete cores (C 174). A detailed discussion by L. W. Teller covering elastic properties of concrete was published in the 1942 Report. Other problems which the committee is considering include test for measuring rate of bleeding or water gain and requirements on rate of loading of specimens. At the June, 1943, meeting a report by C. E. Proudley of the North Carolina State Highway Department covering a new method for making test specimens from vibrated concrete was distributed to the Committee C-9 members for study. Revised Report on Significance of Tests of Concrete and Concrete Aggregates issued in 1942.

Studies of Concrete Aggregate (Committee C-9, Sub. IX).—Based on the research work of this committee, various tests issued including soundness test (C 88 and C 137), abrasion (C 131), methods of determining clay lumps (C 142), and others. Also, numerous specifications for aggregates. 1939 Report included proposed test for soundness by use of sodium sulfate and magnesium sulfate (C 88) and for organic impurities in sand by pH value. Based on recent extensive studies of mortar tests in ten different laboratories, major revisions recommended in standard test for structural strength (C 87). 1943 paper by Messrs. Hubbard and Williams covered use of Los Angeles machine in determining abrasion, paper entitled "Strength of Concrete as Related to Abrasion of the Blast Furnace Slag Used as Coarse Aggregate."

Gypsum; Mortar; Masonry

Methods of Testing Gypsum (Committee C-11, Sub. IV).—Based on several years' previous study of the ammonium acetate method for determining purity of gypsum, the proposed method was included as an alternate in the Standard Methods C 26 in 1942. Problems currently to be the subject of research work include a test for determining water permeability of gypsum sheathing board and study of subsieve fineness determination of gypsum particles.

Testing Mortars for Unit Masonry (Committee C-12, Sub. II).—Broadly this involves investigations on the properties of mortars and the development of satisfactory testing procedures. Subjects involved in studies relate to efflorescence, workability, soundness, etc. 1942 C-12 Report includes discussion on results of extensive cooperative tests—concerns strength of masonry mortars, strength of cement-lime-sand mortars, flow, flow after suction. Current paper by J. C. Pearson discusses "Measurement of Bond between Bricks and Mortar," (1943 *Proc.*). Recommends as a laboratory test a mechanized assembly of the old cross-brick couplet for determining bond in tension.

Weathering Characteristics of Masonry Materials (Committee C-15, Sub. II).—Studies carried out by committee members have been reported in the *Proceedings*, 1935, 1936, 1938 and 1939, covering such topics as water absorption, freezing and thawing test, disintegration of face brick. Extensive investigation on resistance of clay building brick to frost action carried out at the National Bureau of Standards. 1942 paper by J. W. McBurney covered "Relations Between Results of Laboratory Freezing and Thawing and Several Physical Properties of Certain Soft-Mud Bricks."

Thermal Insulating Materials

Physical Properties of Thermal Insulating Materials (Committee C-16, Subs. I to V). Involves various types of material including blocks, cements, blanket type, and others. Tests for compressive strength, flexural strength of blocks. Other tests issued covering insulating cements. Also, thickness and density of blanket type materials. Studies have involved effect of prolonged heating on block type and mechanical stability of wool type insulation after prolonged heating. Twelve emergency specifications issued in 1942 covering most widely used materials.

Conductivity of Thermal Insulating Materials (Committee C-16, Sub. VI).—Based on very extensive work over some years carried out through a joint committee of the American Society of Heating and Ventilating Engineers, American Society of Refrigerating Engineers, National Research Council, and A.S.T.M., on which Subcommittee VI functions as the A.S.T.M. group, a proposed test for thermal conductivity of materials by means of the guarded hot plate was issued. This test was investigated in six laboratories with four types of material involved. The same specimen of each material was tested in two or more laboratories. Satisfactory agreement was obtained. Issued by A.S.T.M. in 1942 (C 177). For detailed discussion of the studies, see 1943 paper by F. C. Houghton on "Conductivity Determination by the Guarded Hot-Plate Method," 1942 *Proc.*

Paints, Petroleum, Coal, Electrical Insulating Materials, Rubber Plastics ("D" Committee Group)

Paints, Varnish, Lacquers

Accelerated Tests for Protective Coatings (Committee D-1, Sub. VII).—A study of accelerated weathering tests for such protective coatings as house paints, enamels, varnishes, lacquers, and metal protective finishes; also correlation of the results with outdoor exposure tests. Resulting from the various studies, some detailed below, are certain specifications and methods, one covering wood panels for use in weather tests (D 358); another preparation of steel panels for exposure (D 609); also evaluating degree of resistance to rusting (D 610). The latter includes reference standards which are pictorial in character and are believed to represent the most practical means for expressing results in terms that can be understood by various interested parties. For detailed report of test results of enamels on steel and correlation with outdoor exposure, see 1940 *Proc.*

1936 and 1937 *Proc.* include reports of various tests including varnishes on steel panels and house paint exposure tests. In 1937 a Symposium on Correlation Between Accelerated Laboratory Tests and Service Tests on Protective and Decorative Coatings was issued. For information from extensive questionnaire on accelerated test for paint coatings see December, 1940, BULLETIN.

Extensive exposure tests carried out at eleven locations to provide a basis for an accelerated test covering tint retention of house paints. A set of pictorial standards applicable for evaluating paint failure is being prepared. Details of tests and results given in 1942 Report.

Various phases of this work continue including activities on

photographic standards for flaking and scaling, and agreement on cleaning methods and preparing metal test panels for painting.

Synthetic Solvents (Committee D-1, Sub. V).—Under a newly organized subcommittee extensive work is planned including study of solvency, *i.e.*, the compatibility of solvents in various mixtures; also methods of analysis of mixtures of various classes of hydrocarbons used as solvents and thinners. These studies are to be carried on in cooperation with the appropriate subcommittees of Committee D-2 on Petroleum Products and Lubricants but the D-1 study will be particularly on the grades of material used in paints and their application to paint. Another project will cover methods for measuring evaporation rates of solvents. While these problems are complicated they are extremely important and interesting results are anticipated.

Consistency of Paint Including Enamel Type Paints and Lacquers (Committee D-1, Sub. VIII).—Based on cooperative investigations of certain instruments including the Stormer viscosimeter, A.S.T.M. consistency cup, Ford cup, etc., standard methods issued including testing nitrocellulose clear lacquers and lacquer enamels (D 333). In 1941 standard method for consistency of exterior house paints (D 562) was adopted embodying use of the Stormer viscosimeter with fork-type rotor. Later this was modified to incorporate the use of the paddle-type rotor.

Preparation and Painting of Structural Iron and Steel (Committee D-1, Sub. IX).—Extensive work under way involving investigation of different methods of surface preparation of steel for painting. Detailed 1941 Report describes research work and summary of various investigations and inspections of panels on exposure; lists reports which cover earlier tests at Havre de Grace and Atlantic City; gives observations of committee in charge. While tests are continuing, the latest plan of the committee involves further series to determine the effect of chemical pretreatment on steel which has been previously painted and then exposed until rusting occurs.

Physical Properties of Paint Materials (Committee D-1, Sub. XVIII).—While the scope is intended to involve various physical properties, particular emphasis has been placed in various investigations on "gloss." Resulting from committee consideration and studies, two methods were agreed on covering spectral characteristics and color of objects and materials (D 307) and specular gloss of paint finishes (D 523). March, 1939, BULLETIN included a paper by R. S. Hunter and D. B. Judd covering "Development of a Method of Classifying Paints According to Gloss."

This subcommittee is preparing a test for the preparation of uniform paint films by the automatic dip method. It is also studying the preparation of films for measurement of gloss. Investigations are being conducted on infrared reflectance and flame testing. The subcommittee is also studying the subject of numerical expression of color differences.

Evaluating Rust Resistance (Committee D-1, Sub. VII).—(See project Accelerated Tests for Protective Coatings.)

Properties and Tests of Varnishes (Committee D-1, Sub. IX).—Studies of the physical and chemical properties of varnishes have resulted in certain A.S.T.M. standards: testing oleoresinous varnishes (D 154), reactivity of paint liquids (D 479), test for phthalic anhydride content of alkyd resin solutions (D 563), and testing liquid driers (D 564). December, 1940, BULLETIN had technical paper by J. McE. Sanderson on "Phthalic Anhydride Determinations in Alkyd Resins" and in the October, 1940, BULLETIN was a paper by W. T. Pearce on "A Study of Methods of Testing and Chemical Analysis of Metallic Driers." The October, 1943, Bulletin includes an extensive technical report by J. C. Moore on "Comparison of Methods for Determining the Drying Rates of Varnishes."

Tests for Traffic Paints (Committee D-1, Sub. IV).—Rapidly increasing use of traffic paints intensified necessity of adequate standard tests, and ultimately specifications. New subcommittee has made rapid progress and as a result of its studies certain standards were issued in 1943 covering: test for dry to no-pick-up time of traffic paint (D 711), light sensitivity of traffic paint (D 712), conducting road service tests on traffic paint (D 713). In its studies the committee has accumulated considerable data on laboratory tests as compared with road durability tests—this will be used in future work. Current problems include the establishment of photographic standards for traffic paint failures, bleeding properties when applied on hard asphalt and tar roads, correlation between laboratory abrasion tests and service wear, and measurement of hiding power and of day and night visibility. A report is in preparation on immersion testing of traffic paints in water, dilute caustic hydrochloric acid, and lime solutions.

Petroleum Products; Asphalt

Kinematic and Saybolt Viscosity (Committee D-2, Sub. V).—Resulting from investigations involving particularly kinematic viscosity were methods of test using the suspended level and modified Ostwald instruments, and a method for conversion of kinematic viscosity to Saybolt Universal viscosity (D 445 and D 446). 1941 Report gives results of interlaboratory study of procedure for determining Saybolt Furol and kinematic viscosity. Proposed method for converting kinematic to Saybolt published for information in 1941, issued as A.S.T.M. tentative standard in 1942 (D 666). Investigations are under way on determining viscosity at low temperatures such as −40 F.

Neutralization Number and Saponification of Petroleum Products (Committee D-2, Sub. XIII).—1941 Report gives results of comprehensive tests keeping numerous variables closely controlled including temperature, time, degree of agitation, strength and type of solvent, and strength of alkali. As a result of this work, the committee has developed two tests for neutralization number, one by color-indicator titration (D 664) another by electrometric titration (D 664). 1942 Report gave summary of cooperative tests on saponification number of fats and fatty oils. Based on this work to determine reproducibility of Methods D 94, revisions were incorporated.

Paraffin Wax (Committee D-2, Sub. III).—Based on cooperative tests in seven laboratories, a proposed method of test for oil content of wax was published for information in 1942—see report of committee. L. L. Davis, Continental Oil Co., presented extensive data at 1943 June meeting on applicability of test. Publication of paper planned for early 1944. Committee plans to extend scope of proposed method for use in wax with not more than 15 per cent oil.

Grease (Committee D-2, Sub. IV).—Previous work in this field involving consistency, melting point of greases, and other properties resulted in development of Method of Test for Dropping Point of Lubricating Grease (D 566–42)—for discussion see 1937 *Proc.* Current activities include study of modified grease worker for determining consistency of grease, effect of speed on working, and effect of temperature on penetration cone. Cooling rate in determining consistency in petrolatum to be studied further in cooperative tests. Various grease tests being studied including Norma-Hoffman bomb test; low-temperature torque test, and cone bleeding tests. Pressure viscosimeter is being built for cooperative work.

Gum in Gasoline (Committee D-2, Technical Committee A, Section 1).—1934 *Proc.* gave discussion of studies on various bomb tests and copper dish method. In 1936, procedure for determining gum content issued, D 381. Results reported in 1939 *Proc.* of a comprehensive series of tests extending over a 5-yr. period, resulting in a method of test for gum stability of gasoline (using bomb test, D 525). There is continuing activity.

Pour Point Test of Petroleum Products (Committee D-2, Sub. XVI).—One problem confronting this subcommittee which developed the widely used test for pour point (D 97) involves pour point stability and studies are under way on this problem. Eventually from the facts developed in cooperative test programs, there will be evolved a proposed test method that will correlate with service conditions.

Color of Petroleum Products (Committee D-2, Sub. VI).—1942 Report discusses two years' work in studying applicability of photoelectric colorimeter to determine color of lubricating oil. This was intensified because of the uncertainty of the supply of color standards used in the Union colorimeter (D 155). As a result of work, proposed method issued—see 1942 Report.

Intensive work by chairman of subcommittee resulted in new emergency standard for color of U. S. Army Motor Fuel (ES-32) comprising sample bottles for visual comparison with instructions. Developed at request of U. S. Army Ordnance. Standard can be obtained from A.S.T.M. Headquarters.

Turbine Oils (Committee D-2, Technical Committee C).—The work of this committee, organized in 1940, was to concern design and use factors which influence life of the oil, rusting behavior of oils, and oxidization stability. There has been informal discussion and papers presented on oil systems of turbines involving purification facilities, foaming, materials of construction, etc. Rusting tests have been studied through cooperative work involving certain non-standardized procedures, one involving contact of a strip of steel with a stirred mixture of oil and small amount of water, and another test in which the strip is dipped alternately in the water and in the oil. Stirring test was selected for further study. For results, see 1942 Report. Tentative method issued covering rust-preventing characteristics of steam-turbine oil in the presence of water (D 665–42).

Based on rather extensive interlaboratory tests of four turbine oils, proposed test for oxidization characteristics published for information in 1943 Report. This report also gives field service data on turbine oils.

Aniline Point (Committee D-2, Sub. XVIII).—Studies by committee resulted in tentative method of test for aniline points (D 611).—Published for information in 1940, tentative standard in 1941. Latest developments indicate that reproducibility of determining mixed aniline points of high solvency naphthas has not been achieved. The subcommittee will make determinations on a series of cooperative samples using normal heptane as a diluent; also will investigate Shell method.

Petroleum Sulfonates (Committee D-2, Sub. XXIV).—In this relatively new field considerable cooperative research work is under way involving study of methods for determining sulfonate content; oil content of sulfonate samples; water, moisture and volatile matter, inorganic salts, etc. Second set of samples to be prepared to be analyzed by various methods agreed on at recent meeting.

Gaseous Fuels

Measurement of Gaseous Samples (Committee D-3, Sub. II).—Intensive work carried out at the National Bureau of Standards to develop procedure for testing laboratory wet gas meters, 1939 *Proc.* Papers by Bean and Morey, and Jilk, covered experimental work, 1939 *Proc.* 1942 Report indicated that a method of altering a wet test meter so as to obtain a flat calibration curve over a fairly wide range of rates, has been worked out. An application for a patent, to be dedicated to the public, is being made to cover this development.

Specific Gravity and Density (Committee D-3, Sub. IV).—In this extensive work carried out at the National Bureau of Standards, fifteen test gases were employed with more than 2000 specific gravity determinations made, using eleven instruments submitted by various manufacturers. An extensive report of some 240 pages was prepared and distributed to the members of the supervising committee and members of Committee D-3. Committee hopes to arrange for publication of the valuable report.

Water Vapor Content of Gaseous Fuels (Committee D-3, Sub. VI).—Intensive work has been carried out at Pennsylvania State College on two methods for the measurement of moisture in fuel gases, namely, a laboratory method which depends on the absorption of light by the water vapor at a particular wave length in the near infrared, and a field method which depends on the change of color of cobaltous bromide in an organic solvent on the addition of water. This investigation is described by F. C. Todd and A. W. Gauger, "Studies on the Measurement of Water Vapor in Gases," 1941 *Proc.* (awarded 1942 Dudley Medal).

1942 field tests were made of improved portable colorimeter using the change in color of cobaltous bromide. Various tests indicated need for better sampling technique. Because of cost of equipment further studies made on measurement of color change with commercial colorimeter. Results with the Evelyn colorimeter considered excellent. Other less expensive methods studied including cloud method (Crismer test) and calcium carbide procedure. See 1943 Report.

Complete Analysis of Gaseous Fuels (Committee D-3, Sub. VII).—Results reported from 30 laboratories cooperating in the work of analyzing a standard sample of carburetted water gas type. With several hundred analyses reported material was presented to the committee as tabular data and as frequency distribution plots. These data gave the first reasonably complete and authentic picture of the actual state of this type of gas analysis in this country at this time. A complete report of analyses of the second standard sample has been prepared and cylinders for distributing third sample of the natural gas type were purchased and equipped with valves.

Determination of Special Constituents of Gaseous Fuels (Committee D-3, Sub. V).—An investigation is now in progress at the Institute of Gas Technology, Chicago, Ill., on the identity and proportions of specific sulfur compounds in gaseous fuels. One investigator is devoting his full time to the preparation of analytical methods covering determination of total organic sulfur, carbon disulfide, carbon oxysulfide, mercaptans, and thiopenes. Proposed standard methods for the determination of these various constituents will probably be ready late in 1943.

Extraction and Recovery of Bitumen from Asphaltic Materials (Committee D-4, Sub. B-6).—The development of a reproducible method for extracting bitumen from various asphaltic materials, particularly pavements, has been the subject of an investigation of this committee since 1940. Prior to the war there was an increasing interest in a reliable method because of the fact that the bitumen content of the pavement has a direct bearing on tendency of the pavement to crack. Various extraction and recovery methods have been used but no reliable standard procedure has been established. The subcommittee has recommended to Committee D-4 a method which is the result of considerable cooperative work of the members. The method is based upon a simple hot extraction of paving sample, a standard procedure for centrifuging to remove the fine mineral matter, and a standardized distillation procedure using CO_2, resulting in the recovery of relatively ash-free bitumen for further testing. The distillation step is based upon the widely used Abson procedure (see 1940 *Proc.*). It was found that complete standardization of the extraction, centrifuging, and distillation steps was required, however, to insure reproducible results. The method is recommended for consideration by all laboratories doing bituminous testing work.

Coal and Coke; Timber

Ignitibility of Coal and Coke (Committee D-5).—Investigations have been carried out to develop suitable tests for determining ignition temperatures of fuels. Paper describing work at Battelle published in the October, 1941 BULLETIN, entitled "Laboratory Tests for Ignitibility of Coal" by Messrs. Sherman, Pilcher and Ostborg. The current problem is to determine whether the values obtained can be correlated with actual burning characteristics.

Plasticity and Swelling of Coal (Committee D-5, Sub. XV).—Studies of methods of testing expanding properties of coals during coke manufacture; series of different coals distributed to cooperating laboratories for test. Investigation of plastic properties of coals as affecting their combustion characteristics also conducted (1938 and 1939 *Proc.*). British Standards Institute crucible swelling test investigated. A paper was presented at the 1942 annual meeting by Messrs. Ostborg, Limbacher, and Sherman, entitled "An Experimental Investigation of the British Standard Method for the Crucible Swelling Test for Coal." This paper describes a standardized method for evaluating the free swelling characteristics of coals. The method of test for free-swelling index of coal (D 720) approved as an A.S.T.M. tentative standard in 1943 is a small-scale laboratory test giving information concerning the free-swelling and coking properties of coal when burned as a fuel. Six other methods for determining plastic properties of coals and for evaluating expansion and pressure characteristics in coke ovens published for information in 1943 Report. See also 1943 technical paper entitled "The Gieseler Method for Measurement of the Plastic Characteristics of Coal" by Messrs. Soth and Russell. See also paper entitled "Test for Pressures, Strains, and Other Properties Developed During Carbonization of Coal" by V. J. Altieri.

Sampling and Tolerances for Coal (Committee D-5, Sub. XIII).—Earlier sampling experiments involving hand and machine methods and various coals with different amounts of impurities resulted in modification of the standard methods of sampling, see 1937 *Proc.* In 1938 the method of sampling coals (D 492) was issued. Extensive changes incorporated in 1943 to cover procedures for sampling large lump coal and run-of-mine coal, based on extensive factual information developed by committee. Sampling procedures for total moisture were based on numerous experiments, some described in a paper published by the U. S. Bureau of Mines entitled "Moisture Losses in Sampling Coal," Report of Investigations No. 3670. Latest problem being studied involves sampling coal for the determination of volatile matter in connection with city smoke ordinances.

Determining Sulfur in Coal and Coke (Committee D-5, Sub-I).—See 1942 Report for discussion of comprehensive study of volumetric methods for determining sulfur. Eight laboratories participated, using samples of four coals with wide ranges in sulfur content. Gravimetric methods used were the standard Eschka and bomb washing methods; while the volumetric methods used certain chemicals as indicators. Results indicated that volumetric methods which are less costly and time-consuming will yield results of the same degree of accuracy as the present standard gravimetric method incorporated in D 271. Details of research investigations were covered in the paper by S. S. Tomkins, "Volumetric Determination of Sulfur in Coal and Coke," *Industrial and Engineering Chemistry*, Analytical Edition, Vol. 14, pp. 141 to 145 (1942).

Uniformity of Analytical Data of Coal and Coke (Committee D-5, Sub. I).—To determine the precision of procedures covered in widely used standard methods of laboratory sampling and analysis of coal and coke (D 271), a special section made a study by applying statistical methods (see paper by Messrs. Lowry and Junge entitled "Statistical Study of the Precision of Methods for Analysis of Coal and Coke," 1942 *Proc.*). Analytical data on 100 samples of coal or coke taken in inverse chronological order to avoid bias were furnished by 19 governmental, institutional, industrial, and commercial laboratories. While the results described in the paper indicate that certain revisions may be desirable in some of the present allowable tolerances for duplicate analysis, no specific revisions are being made at this time. Special section discharged with completion of the assignment.

Coal Ash Fusion Test (Committee D-5, Sub. I).—To obtain information on how best to specify the nature of the reducing atmosphere in the standard coal-ash fusion test a cooperative investigation has been completed in which seventeen different laboratories took part. Gas-fired and electrically heated furnaces were used. The fuels used for heating the gas-fired furnaces included natural gas, manufactured gas, coke-oven gas, and oxygen-acetylene mixtures. The cooperating laboratories determined in duplicate the initial deformation temperature, the softening temperature, and the fluid temperature of a series of coal ashes covering a wide range of fusibility. The data reported are being tabulated for publication as a Bureau of Mines Report.

Coal Sampling (Committee D-5, Sub. XIII).—Experimental work has been contemplated relative to the number of increments required in collecting samples of coal with the top size ranging from four to six inches. Temporarily the subcommittee in charge has recessed its work involving methods of sampling coal for determination of moisture.

Moisture in Timber (Committee D-7, Sub. XI).—There is no active organized research work on various methods and equipment for determining moisture in timber, either in the laboratory or in the field, but members of the committee are accumulating experiences with instruments that have been developed, and the project is one that can be considered currently in mind. For studies of determining moisture in heavy timber by electrical measurement see 1933 *Proc.*, for report with data on the steam pipe oven for determining moisture, see 1936 *Proc.*

Electrical Insulating Materials

Power Factor and Dielectric Constant of Electrical Insulating Materials (Committee D-9, Sub. XII).—Previous research work resulted in development of standard resistivity test (D 257) and in revisions of the test for power factor (D 150). For description of extensive work on solid dielectrics, see 1941 Report. The committee concerned has planned an extensive program of work which will be undertaken when time and personnel conditions are favorable. It is expected considerable progress will be made in measurements of insulating liquids, and in tests for both solid and liquid insulations at ultra-high frequencies.

At the request of the War Committee on Radio a program of work has been undertaken for the study of low and high temperatures on power factor measurements, also the effect of specimen size, conditioning procedure, and test temperature on insulation resistance of sheet materials.

Solid Treating and Filling Compounds for Electrical Insulation (Committee D-9, Sub. VI).—Since no satisfactory accelerated test has been developed for determining the solubility in cable oil of solid filling and treating compounds, this problem is being studied. Additional tests are being carried out to find some suitable method of evaluating this property and progress is reported. Previous work on various tests resulted in standards covering methods of measuring coefficient of expansion and power factor and dielectric constant (D 176).

Varnished Cloth Tapes (Insulating Fabrics) (Committee D-9, Sub. VII).—The extended research on the elongation-dielectric strength characteristics of various types of varnished cloth tapes is intended to furnish data for revisions in the specifications for black bias-cut tape, D 373. When the requirements were established, insufficient data necessitated very conservative requirements. Work in the past few years has given the committee a better picture of what takes place in tape as wound by the average user and consequently a sounder basis for more satisfactory requirements. Currently the work involves the technique of making dielectric strength tests on the tape specimens while still under tension.

Tests of Electrical Insulating Papers (Committee D-9, Sub. VIII).—For some time a joint committee sponsored by Committees D-9 and D-6 has been investigating pH methods for acidity determination of paper samples. Previously there have been discrepancies in the results, but the cause has been eliminated and it is hoped a standardized test can be approved. Round-robin tests are under way.

Tests of Electrical Insulating Sheets, Tubes, and Rods (Committee D-9, Sub. III) (Laminated Phenolic Sheets) (Punching).—Based on a long program of cooperative tests including development of a standard punching die and a high rating system for evaluating edges, surfaces, and holes in specimens, a test for punching quality of laminated phenolic sheets has been issued (D 617). Hardness tests at room temperature or elevated temperatures according to the punching temperature have been found to give an indication of quality. For details, see Appendix, 1941 Report.

1942 Report announced completion of round-robin test on rate of burning of varnished tubing using Underwriters' Methods and A.S.T.M. method (D 350). The latter is being retained. Likewise the dielectric strength requirements in the above methods and also in the tentative specifications (D 372) proved to be satisfactory. Studies of the flexural strength test have continued. 1942 Report included discussion on power factor measurements of laminated sheet.

Tests of Electrical Insulating Varnishes (Committee D-9, Sub. I).—Despite numerous perplexing problems in this work involving test for resistance of varnish to alkali, impregnating qualities of varnish and related matters, the committee is continuing its efforts. On the problem of internal drying time of saturated varnish the objective is to perfect a test under a condition which simulates practical conditions, but problems arising have not been solved. Investigations of tests for deep drying varnishes and for acid and alkali resistance of varnishes continue.

Bureau of Ships, U. S. Navy Dept., has developed tests for determining deep drying characteristics of varnishes used generally for impregnating electrical coils, armatures, etc. In addition to the Navy laboratory, three company laboratories are participating in cooperative tests to determine whether the procedure will satisfactorily evaluate a varnish for drying or hardening in the interior of a deep layer coil.

Tests of Electrical Liquid Insulation (Committee D-9, Sub, IV).—1943 Report gives condensed summary of activities involving neutralization number, sludge test, insulating oils, and askarels, and resistivity and power factor test.

Neutralization Number.—Several years of investigation in cooperation with Committee D-2 have resulted in the approval of tests for neutralization number (D 663) and the electrometric titration test (D 664). For supporting data on round-robin tests, see 1943 Report.

Sludge Test.—After long-time consideration and study a new test for sludge formation in mineral transformer oil (D 670) was standardized in 1942. Work is under way correlating data obobtained in this test with actual service. This must be done before purchase specification limits can be established.

Various companies will study transformers, with samples of oils taken periodically and tested. Work must extend over a period of several years before the proposed test can be completely evaluated.

Water in Insulating Oil.—Samples of oil, one a new oil the other slightly used, were tested by members of Section N and a procedure for the use of the Carl Fisher reagent was also sent so that section members could evaluate it on the same oil samples and give in their report the data on this as well as their own procedure.

Insulating Oils and Askarels.—An important development is the publication as information of a proposed method of testing askarels. These are synthetic noninflammable insulating liquids which when decomposed by the electric arc evolve only nonexplosive gaseous mixtures.

Resistivity and Power Factor Test.—This work is in cooperation with the subcommittee on power factor of liquids and concerns investigations to develop a satisfactory test procedure for power factor and resistivity of insulating oils.

Tests of Molded Electrical Insulating Materials (Committee D-9, Sub. II).—Early investigative work resulted in standard methods of testing molding powders (D 392); later a method of measuring shrinkage from mold dimensions (D 551) was standardized. Because of the importance of mold design on tensile specimens, interlaboratory work was undertaken to procure data from which a standard mold design could be prepared.

An important activity has been to establish specified values for electrical tests of phenolic materials. Much of this work is of interest to Committee D-20 on Plastics. For current technical papers of interest, see 1943 *Proc.*—Messrs. Telfair and Nason on "Impact Testing of Plastics—I. Energy Considerations," and Robert Burns on "Deformation Under Load of Rigid Plastics."

Thermal Properties of Electrical Insulating Materials (Committee D-9, Sub. III).—Round-robin tests have been carried out on different materials using Methods D 696 (coefficient of linear thermal expansion of plastics). As a result tests for thermal expansion will be added to the test method for plate and sheet material, D 229. Other round-robin tests on flammability methods showed that the requirements in D 229 were not satisfactory for certain materials and a note will be added to the standard. Other studies will be undertaken in cooperation with Committee D-20 on Plastics involving distortion point and heat resistance of thermosetting materials.

Tests for Properties of Ceramic Products for Electrical Purposes (Committee D-9, Sub. V).—Cooperative tests carried out have involved flexural strength, tensile strength of electrical porcelain, and methods of determining mechanical strength of steatite. 1941 *Proc.* included a "Report of Round Robin Tests on Power Factor and Dielectric Constant for Glass," describing the work at five laboratories on five different types of glass to help in correlating measuring technique. New work will involve study of tests for high dielectric constant of ceramic materials, particularly the electrical properties and a testing program has been agreed on. The committee is studying the use of the "Prestone Machine" as an alternate method for determing resistance to thermal shock.

Mica and Mica Products (Committee D-9, Subcommittee IX).—Based on an electrical system of classifying mica, proposed specifications for natural block mica have been completed, and it is expected will be submitted to the Society soon for approval. The new methods are considered to have many advantages over the visual system. The extensive groundwork connected with this development was instituted and carried to completion by the Bell Telephone Laboratories under WPB contract. The work has indicated that certain classes of mica heretofore thought unsuited for certain particular electrical application can be used quite satisfactorily. This is a worthy contribution to the war effort since it will make available to the manufacture of mica dielectric capacitors a quantity of block mica which normally was thought unsuited as gaged by the visual method of classification.

Arrangements have been made to secure a trial lot of three different mica samples reproduced in color. These will be lithographed on transparent plastic. Pending approval of the trial lot, an entire set of mica selected to show various grades or classifications will be reproduced and made available upon order. It is felt that such a series of photographs may prove to be of material value to those using the visual system of classifying mica.

Rubber Products

Automotive Rubber (Technical Committee A of Committee D, 11, Functioning as a Joint S.A.E.-A.S.T.M. Committee).—Extensive investigative work carried out by this group has involved a suitable hardness testing machine, requirements for motor mountings in which over 1400 determinations were made in cooperative tests, and research work on bumpers which has included load deflection and impact tests and heat failure of bumper stocks. Work has resulted in important standards including testing automotive hydraulic brake hose (D 575) and testing automotive air brake and vacuum brake hose (D 622), and just this year standard tests for low-temperature brittleness of rubber and rubber-like materials (D 736). Research is being continued to develop more comprehensive tests for low-temperature properties. Another phase of this work involves automotive fan belts made from synthetic rubber. Because it has been difficult to select a suitable laboratory test, a field service investigation is under way. (See 1942 and 1943 Committee D-11 Reports.)

Chemical Analysis of Rubber Products (Committee D-11, Sub. XI).—Several research projects have been completed to develop satisfactory analytical methods for determining various elements, see 1938, 1939, 1940 *Proc.* for discussion. Modernized methods of chemical analysis issued as tentative in 1940. 1941 and 1942 cooperative tests covered determination of cellulose and carbon black in rubber compounds. A new section on methods of analysis for synthetic rubber has been organized and work is under way—latest report circulated in subcommittee. For technical paper see January, 1943, Bulletin, "A Direct Determination of Rubber Hydrocarbon by Chromic Acid Oxidation Method," Messrs. Burger, Donaldson, and Baty. This method to be issued as alternative A.S.T.M. tentative procedure.

At June meeting recent reports on variations in analysis of rubber and sulfur, including the copper gauze method and free sulfur, were discussed. Subcommittee to study this material and to submit any relevant data so that adequacy of present requirements can be determined. Committee also discussed determining cellulose in carbon black, in which field much previous work was done. Committee realizes various activities comprise rather ambitious program, but will make all progress possible.

Aging or Life Tests of Rubber Products (Committee D-11, Sub. XV).—Accelerated aging tests of various types of rubber compounds in comparison with natural aging of the same samples. Previous methods of test for accelerated aging of vulcanized rubber separated in 1940 into procedures by oxygen-pressure method (D 572) and oven method (D 573). Method for air pressure heat test of vulcanized rubber (D 454) adopted.

Method of testing rubber compounds for resistance to light checking and cracking (D 518–38 T) issued (1938 *Proc.*). A cooperative test program conducted to determine the uniformity of aging in the various types of apparatus currently used in different laboratories completed; for conclusions see 1939 *Proc.* For discussion of methods of testing rubber compounds for resistance to accelerated light aging and of calibrating light source used see 1940 *Proc.* 1942 Report gives extensive discussion by J. H. Ingmanson on investigation of artificial light aging of rubber, with the conclusions from research work undertaken, and various data. Draft of method for calibrating a light source used for accelerating the deterioration of rubber was discussed at June meeting and is to be referred to the Society for publication as tentative standard.

Packings (Rubber and Rubber-Like Materials) (Committee D-11, Sub. VI).—Based on studies of several years, including thorough surveys of the field, methods of testing compressed asbestos sheet packing (D 733) issued in 1943. Further studies to cover effect of varying humidity conditions. This type packing is used for a variety of purposes, but particularly for aircraft engines. The subcommittee is working on treated paper packings. In 1941 series of technical papers presented, at March committee meeting. See 1941 *Proc.* For interesting paper on "Machines for Testing Reciprocating Packings," by F. C. Thorn see May, 1942, BULLETIN.

Properties of Rubber and Rubber-Like Materials in Liquids (Immersion Tests) (Committee D-11, Sub. XIX).—Rather extensive research investigations on evaluating materials for oil resistance covered in 1934, 1935, 1937 *Proc.;* also methods for changes of properties of rubber and rubber-like materials in liquids, issued, D 471. Later discussion resulted in recommendation to use three standard petroleum-base test oils with specified aniline points. Subcommittee is continuing work to develop narrower specification limits for oils used, and to establish requirements on motor fuels for use in immersion tests. Two reports from the United States Navy Department, Bureau of Shipping were distributed to Subcommittee covering "Solvents and Water Permeability Apparatus for Impregnated Fabrics" and "Report of Tests on the Effect of Temperature on the Solvent Resistance of Synthetic Rubber Vulcanizates."

Adhesion of Rubber to Metal (Committee D-11, Sub. XX).—Based on extensive earlier research work, test for adhesion of rubber to metal issued (D 429). Data resulting from cooperative tests published, 1938 *Proc.* There is renewed interest on effect of shape of test specimen and studies are now getting under way to try to improve requirements for specimens, particularly for soft, stretchy stocks.

Testing of Liquid Rubber Products, Cements, Latex, etc. (Committee D-11, Sub. XXI).—Work previously done resulted in methods of test for viscosity and total solids content, D 553, see 1939 *Proc.* Present work is to develop minimum number of tests required to determine adhesive properties. Study of other viscosity test methods than D 553 temporarily held in abeyance. Extensive work by subcommittee sections resulted in agreement on necessary tests for adhesive properties including (1) initial film strength, (2) ultimate film strength, (3) applicability (usability, brushability, sprayability, etc.), and (4) bonding range.

Sponge Rubber (Committee D-11, Sub. XXII).—Present emergency has stressed necessity of specification requirements for various types of sponge rubber. At June meeting proposed general specifications were drafted but insufficient data in some cases must be supplied by a cooperative testing program. Active work will involve chemically blown sponge rubber and closed cell type with objective of issuing emergency specifications. Efforts will be made to obtain data on foamed rubber latex sponge rubber. Methods of testing these products first issued 1939, now D 552 – 43 T.

Hard Rubber and Hard Rubber Products (Committee D-11, Sub. XXIII).—1938 and 1940 *Proc.* discuss briefly extensive cooperative testing programs. Methods of testing issued, D 530, also procedures for evaluating battery containers, D 639. Studies will probably result in modification of latter standard. Extensive round-robin tests by 11 laboratories for tensile properties as covered in D 530, showed considerable variation. Additional studies will be made on effect of variables.

Rubber Coated Fabrics (Committee D-11, Sub. XXIV).—Very active program of work outlined at June meeting. Properties which need evaluating include abrasion resistance, scrub resistance, light aging, and gas permeability. Committee will discuss tests on taber abrader for comparison with other machines. Tests reported by various laboratories with the scrub machines were inconsistent and committee hopes to have a machine designed for cooperative work. It will expedite this program because of urgent need of tests. Proposed new tentative standards will cover other tests previously investigated including breaking, and bursting strength and elongation, tear resistance, hydrostatic resistance and adhesion of coating to fabric.

Low Temperature Tests of Rubber and Rubber Products (Committee D-11, Sub. XXV).—With intense interest in the low-temperature characteristics of rubber and nonrigid plastics, a new subcommittee was organized in March, 1943, and based on a thorough survey promptly developed the tentative tests for low-temperature brittleness (D 736–43 T). This has been approved by Technical Committee A for use in evaluating resistance of freezing temperatures of rubber and rubber-like materials for use in automotive products. The subcommittee has adopted a comprehensive program of work. Four types of tests will be investigated, based on the following characteristics: (*a*) brittleness, (*b*) hardness and modulus, (*c*) loss of resilience, and (*d*) fatigue and flexing. In each project the respective committee will select the most suitable test and attempt to standardize it with the type of cold box specified only by performance. Temperatures down to −70 F. must be considered. See 1943 *Proc.*

Soaps and Other Detergents

Tests on Soap and Other Detergents (Committee D-12).—Cooperative laboratory work has been carried out on a method to evaluate sulfonated detergents by washing a standard soiled cloth in a launderometer under various conditions. For detailed summary of work see paper by J. B. Crowe, 1943 D-12 Report. Includes typical procedure used for soiling and washing. Research work in various laboratories carried out on a method of analysis for tetrasodium pyrophosphate. The agreement among the eleven laboratories was good and new procedures in methods of sampling and chemical analysis of special detergents was satisfactory. For results of tests see 1942 *Proc.*

Dry Cleaning Detergents (Committee D-12, Sub. I and II).—1942 Report indicated progress in developing the method for evaluating dry cleaning agents, but dry cleaning tests include serious problem of finding a means of producing soiled pieces meeting certain requirements.

Metal Cleaners (Committee D-12, Section G).—To determine the efficiency of the methods of chemical analysis of industrial metal cleaning compositions published for information in the 1942 Report and in the special compilation of standards of Committee D-12, samples of representative metal cleaning compositions were to be prepared and analyzed in cooperative tests. Another important project in the committee is the Annotated Bibliography of Aluminum Cleaning as compiled by J. C. Harris and R. B. Mears. This was published in the January and March, 1943, BULLETINS; also in the special compilation of standards. Because of very extensive use of aluminum, this work was considered very timely.

Textile Materials

Tests for Bleaching, Dyeing and Finishing of Textiles (Committee D-13, Sub. G-4).—Work in these fields has been very active, with considerable research, including cooperative tests. These have resulted in important test methods covering the following: resistance to water (D 583), resistance of textile fabrics and yarns to insect pests (D 582), fire-retardant properties of

treated textile fabrics (D 626), evaluating compounds designed to increase resistance of fabrics and yarns to insect pests (D 627), and resistance of textile fabrics to microorganisms (D 684), and numerous others involving laundering, fastness to light, determining copper and manganese in textiles, etc. See 1943 compilation of A.S.T.M. Standards on Textile Materials. Current work involves interlaboratory tests using Methods D 582, resistance of textile fabrics and yarns to insect pests, with several types of moth repellents to be studied. New materials coming into military use are to be studied from the standpoint of fire-retardant properties. A program has been developed to carry out urgently needed research and accelerated tests. For proposed tests for accelerated aging see latest standards compilation.

Rayon and Its Products (Committee D-13, Sub. A-2).—The subcommittee in charge of work in this field has previously been most active and although members have had to concentrate on war problems certain work continues. Some nine important standards giving methods and tolerances for rayon and rayon products have been issued, a number in the past few years. Current studies involve dimensional restorability tests, that is determining shrinkage of fabrics after laundering. Work on identifying different types of rayon, with comparative properties, is temporarily held in abeyance because of the numerous rapid developments in the field. One group is studying the application of the inclined plane tester for rayon yarn, particularly the rate of loading.

Tests of Wool and Its Products (Committee D-13, Sub. A-3).—Intensive standards work which involved research testing resulted in various test methods and specifications covering fineness, fiber length of wool, and methods of testing various wool products, and cover hearts of wool, pile, filler, etc. The 1942 Report indicated studies under way on effect of tension in reeling on yarn number determination, and interlaboratory tests are being carried out and fineness measurement of top, card sliver, and oils. In the work on pile floor covering the section is preparing a program for post-war research on the correlation of laboratory wear testers with actual service tests for fabrics containing vegetable and synthetic fibers in the pile.

Felt (Committee D-13, Sub. A-3, Section II).—Work in this field resulted in publication several years ago of methods of testing wool felt—these methods were consequently revised and now carry the designation D 461 – 40. While no active research program as such is now under way, the various manufacturers and users represented on the section have developed information and data which the committee plans to assemble and correlate for use in its standardization development program.

Rosin; Soils

Properties and Tests of Rosin (Committee D-17).—An important problem in this field on which work has been under way for several years is the development of a satisfactory means for determining crystallization tendency of rosin. Information on this work and on other investigations of tests for properties have appeared in the *Proceedings* for 1934 through 1941. Several test methods issued including acid number (D 465) and saponification number (D 464). Methods for determining insoluble matter, ash, petroleum ether discussed in *Proceedings*, Vols. 38, 39, 40. 1941 Report gives summary of results of collaborative tests and crystallization tendency. Activities of committee being expanded to include investigations on tall oil (liquid rosins), pine tar and tar oil, and terpene hydrocarbons and pine oil.

Soils for Engineering Purposes (Committee D-18).—Based on research work carried out under committee auspices, by individual members and by organizations with which members are connected, numerous testing methods have been standardized, see Book of A.S.T.M. Standards. As part of its research activities the committee has stimulated the preparation of technical papers and has sponsored two notable groups of papers, one in 1939—a Symposium on Shear Testing of Soils (see 1939 *Proc.*) and in 1943, a Symposium on Soil Test Methods which covered a large number of tests under such groupings as indication and compaction tests, shear test, test for bituminous mixtures, tests for soil cement mixtures. Current paper by E. E. Bauer on "Factors Affecting Specific Gravity Values in the Proposed Method of Test for Soils," published in the December, 1943, Bulletin.

Water

Analysis of Industrial Waters (Committee D-19).—Through participation of committee members in the work of the Joint Committee on Boiler Feedwater Studies, research work of the U. S. Bureau of Mines, and other agencies, and by discussion at meetings and the development of numerous technical papers and round-table discussions, this committee has had the benefit of important technical data. On these have been based numerous methods for determination of various ions. For papers of definite interest, see *Proceedings*, Vols. 37 to 43, incl. For very pertinent discussion of solvent action of water vapor at high temperature and pressure, see 1942 *Proc.* Includes general introduction by Max Hecht, and extensive fundamental paper by G. W. Morey on "Solubility of Solids in Water Vapor." Includes combined bibliography. 1943 *Proc.* will include Symposium on the Identification of Water-Formed Deposits, Scales, and Corrosion Products by Physico-Chemical Methods, with specific contributions on spectrographic X-ray diffraction and other quick methods, diagnosis of water problems, and interpretation and analysis of problems encountered in water analysis deposits. One of the main purposes of the symposium was to illustrate increased information that is secured when modern laboratory tools are utilized in analysis and identification. For other technical papers dealing with boiler feedwaters, particularly dissolved oxygen, see 1943 *Proc.*

Boiler Feedwater, Particularly Caustic Embrittlement (Joint Research Committee, sponsored by six societies).—The research on caustic embrittlement has reached a logical stopping point. This phenomenon, it has been concluded, is a function of the chemical character of the water and stress in the metal at a point where there is excessive concentrations of alkaline salts in the water. The U. S. Bureau of Mines investigators will continue to assemble and correlate reported data pertaining to boiler failures suspected of resulting from caustic embrittlement. A new committee sponsored by the Joint Research Committee is now organizing a research project in which the cause and remedy of the effect of silicon in boiler waters and steam generated from those waters will be studied.

For papers on determining oxygen in boiler water and related problems, see 1936 *Proc.*, also 1943 *Proc.* Papers just being published particularly pertinent. 1937 *Proc.* included report on effect of solution on intercrystalline cracking. 1938 August BULLETIN discusses prevention of cracking by lignins.

Members of the Joint Research Committee continue to cooperate closely with A.S.T.M. Committee D-19 on Water for Industrial Uses to which is referred such material as is suitable and ready for standardization. For additional notes, see material above on industrial water.

Plastics

Strength Properties of Plastics (Committee D-20, Sub. I).—Tests which have been standardized through investigations in this field cover impact resistance (D 256), tensile properties (D 638), compressive strength (D 695), and flexural stress (D 671). Also, test for shear strength. Others cover stiffness and flexural strength, and brittleness. Being investigated are methods for determining properties at high and low temperatures; tensile properties of thin sheet material; test for bearing strength and impact strength at high speed or under load. Standard molds are being designed for all test specimens.

Hardness Properties of Plastics (Committee D-20, Sub. II).—Certain phases of investigations carried out by this group are particularly pertinent in the war effort. The tests for deformation under load at elevated temperatures (D 621), mar resistance (D 673), long-time tension tests (D 674) are in this category. Tests which the committee is investigating eventually will cover the following: Rockwell hardness, scratch resistance, creep, wear resistance of bearings, and coefficient of friction.

Thermal Properties of Plastics (Committee D-20, Sub. III).—Various round-robin tests have been carried out and proposed methods of test have resulted covering such properties as flammability of plastics (D 568), flow temperatures (D 569), coefficient of expansion (D 696), measuring relative mobility (D 731). In the 1943 Report the committee indicated the following are under study: methods of test for cubical expansion, rate of burning at high temperatures (glo-bar test), and a simplified procedure for determining heat distortion.

Optical Properties of Plastics (Committee D-20, Sub. IV).—The problems studied by this committee have included surface irregularities, diffusion of light, testing for haze, index of refraction, and related characteristics. Several methods have been standardized and issued.

Permanence Properties of Plastics (Committee D-20, Sub. V).—As in certain other materials fields, the question of accelerated service testing is a problem confronting the group active in this field. Investigations so far carried out have resulted in various tests: colorfastness (D 620), water absorption (D 570), resistance to chemical reagents (D 543), water vapor permeability (D 697), and agreement is expected in the near future on a test for resistance of plastics to extreme service conditions.

Analytical Methods (Committee D-20, Sub. VII).—Current report (1943 *Proc.*) indicates this new subcommittee has made considerable progress on test methods for methanol soluble content and viscosity of polystyrene and on a method of determining acetyl and butyryl content of cellulose acetate butyrate. It is actively engaged in tests on nitrocellulose, methacrylates, and chlorine containing resins. Also under consideration are methods for determination of plasticizer content and specific gravity.

Impact Testing of Plastics (Committee D-20, Sub. VIII).—The first problem on which the new Subcommittee VIII on Research will concentrate is strength under impact, involving all phases of impact testing. For current technical paper by Messrs. Telfair and Nason on "Impact Testing of Plastics—I. Energy Considerations" see 1943 *Proc.*

Miscellaneous—Consistency, Particle Size

Determining Consistency (Committee E-1).—Work of this committee has included perfection of test method for softening point by the ring-and-ball apparatus (E 28). 1940 Report summarized comparison studies of tapered and shouldered rings. Important publication was 1937 Symposium on Consistency. 1942 Report included discussion of work on softening point of rosin involving collaborative tests on referee samples with tapered and shouldered rings. Conclusion reached that factors other than difference in ring design apparently exert more effect.

Particle Size Measurement (Committee E-1, Technical Committee III, Section on Pigment-Type Materials).—Cooperative work was carried out some time ago to develop information on the fundamental validity and experimental reproducibility of microscopic measurements. One aim was to verify work that indicated particle size measurement would vary with the difference between the refractive indices of the mounting media and the particles. Additional measurements were made on marked fields of microscopic mounts of three or four actual pigments. While complete tabulation of the results has not been made nor the work analyzed, quite good agreement resulted on the average diameter. Further work is to be carried out when personnel and equipment are available. Committee also plans to develop other methods including some discussed in the 1941 Symposium on Particle Size Measurement (issued as special publication).

Calendar of Society Meetings

(Arranged in Chronological Order)

American Association for the Advancement of Science—December 27–January 1, Cleveland, Ohio.

Society of Automotive Engineers—Annual Meeting and Engineering Display, January 10–14, Book-Cadillac Hotel, Detroit, Mich.

American Physical Society—January 13–15, New York, N. Y.

War Production Clinic—Sponsored by New York Committee on War Production, January 14, Commodore Hotel, New York, N. Y.

American Society of Civil Engineers—Annual Meeting, January 19–21, New York, N. Y.

American Institute of Electrical Engineers—National Technical Meeting, January 24–28, Engineering Societies Building, New York, N. Y.

National Sand & Gravel Association—Annual Meeting, January 25–27, Hotel New Yorker, New York, N. Y.

American Society of Heating and Ventilating Engineers—Fiftieth Anniversary Meeting, January 31–February 2, New York, N. Y.

National Crushed Stone Association—Annual Convention, January 31–February 2, Hotel New Yorker, New York, N. Y.

American Institute of Mining and Metallurgical Engineers—Annual Meeting, February 20–24, Waldorf-Astoria, New York, N. Y.

American Concrete Institute—Annual Convention, February 29–March 2, Chicago, Ill.

American Ceramic Society—Second War Congress—Forty-sixth Annual Meeting, April 2–5, Hotel William Penn, Pittsburgh, Pa.

American Society of Mechanical Engineers—Spring Meeting, April 3–5, Birmingham, Ala.; Semi-Annual Meeting, June 19–22, Pittsburgh, Pa.

American Society for Testing Materials.—Spring Meeting and Committee Week, February 28–March 3, Netherland Plaza, Cincinnati, Ohio; Forty-seventh Annual Meeting, Waldorf-Astoria, June 26–30, New York, N. Y.

Men of Research

A laboratory is people—scientists, glass blowers, technicians, shop workers, metallurgists. It is many people of varied skills and talents.

¶It takes years to build up the personnel of such an institution—years of searching and sorting for the minds best adapted for research and the dispositions most likely to contribute to the teamwork so essential to the success of a venture like this.

¶"The only perpetual motion is the growth of truth," Dr. Whitney will tell you.

¶"Great discoveries are not made accidentally, because accidents never happen unless you are going some place."—so says Coolidge.

—Excerpts from *Story of Research*, General Electric

Fire Codes for Liquids, Gases, Chemicals, etc.

An extensive publication giving National Fire Codes for Flammable Liquids, Gases, Chemicals, and Explosives has recently been published by the National Fire Protection Association, 60 Batterymarch Street, Boston 10, Mass. This was compiled by Robert S. Moulton.

These codes which deal with various phases of the regulations of hazards of the materials covered are in the form of suggested ordinances, standards, and recommended good practice requirements. While purely advisory from the N.F.P.A. standpoint, they are widely used as a basis of law, and as an administrative guide.

The publication is divided into nine sections, covering the following: Flammable Liquid Storage and Handling; Oil and Gasoline Burning Equipment; Liquefied Petroleum Gases; Utilization of Flammable Liquids; Gases; Refrigeration and Fumigation; Explosives and Nitrocellulose Materials; Tables of Properties of Hazardous Chemicals and Flammable Liquids; Flash Point Tests. Preceding each section is a brief history of the material.

Copies of the 510-page book can be obtained at $3 per copy.

ASTM Bulletins—1943

Subject Index

Papers and Reports

Fuel Supply and Demand

Late in April, Dr. A. C. Fieldner, Chief, Fuels and Explosives Service, U. S. Bureau of Mines, addressed a meeting of the Western Society of Engineers in Chicago to which members of A.S.T.M. had been invited, on the subject "Recent Developments in Fuels Supply and Demand." This efficiently supplemented and brought up to date an address on "Fuels of Today and Tomorrow" which was Doctor Fieldner's Presidential Address at the 1937 A.S.T.M. Annual Meeting. The current paper has been published in the September, 1943, *Journal* of the Western Society of Engineers. Dr. Fieldner concludes, "Relatively, the situation with respect to both oil and coal has been more satisfactory thus far than it was during the last war. Our greatest lesson is an appreciation of the great military value of petroleum products and the necessity of a national point of view in the utilization of this much more limited national resource as compared with our abundant reserves of coal. Let us hope that we will follow a sound, rational policy in making the best use of a rich heritage of mineral fuels."

Article on Cadmium Plating

In the October 11 issue of *Steel*, K. Gustaf Soderberg, who is very active in A.S.T.M. work and is now consultant, WPB Conservation Division, on leave from his company, The Udylite Corp., has an interesting article on conserving our supplies of cadmium which are now at a very critical point. Members and others concerned with this problem will undoubtedly wish to study the article. There are a number of references including several to A.S.T.M. publications and specifications.

Inspection and Control of Weights and Measures

A publication that may be of interest to a number of members has recently been issued by the U. S. Government Printing Office entitled "Inspection and Control of Weights and Measures in the United States." Copies can be obtained from the Superintendent of Documents at 15 cents each. This 96-page publication gives a condensed historical and legal background of this important subject, but the major portion is devoted to results of an extensive survey by a Division of the U. S. Department of Agriculture, listing comments of state officials, characteristics of present laws, data on staff, budgets, inspectional activities, tests of equipment, etc., with appendices of helpful supplementary information. This book ties in with Federal work in standardizing quality of metals used in coinage and the establishment of price ceilings with, in some cases, quality specifications.

NEW MEMBERS TO NOVEMBER 15, 1943

The following 54 members were elected from October 1 to November 15, 1943:

Chicago District

KEARNEY & TRECKER CORP., J. B. Armitage, Vice-President in Charge of Engineering, 6784 W. National Ave., Milwaukee 14, Wis.

KRIZ, ANTHONY, Metallurgist, Rheem Manufacturing Co.; and Assistant Engineering Chemist, Testing Section, Bureau of Engineering, City of Chicago, Chicago, Ill. For mail: 7150 S. Mozart St., Chicago 29, Ill.

MADSEN, M. JOHN, Manager, Fuel Div., Chicago Better Business Bureau, 7 S. Dearborn St., Chicago 3, Ill.

STEEVER, ADAM M., General Superintendent, Columbia Tool Steel Co., Chicago Heights, Ill. For mail: 12100 S. Greenwood Ave., Blue Island, Ill.

WYMAN, CLYDE H., Metallurgist, Burnside Steel Foundry Co., 1300 E. Ninety-second St., Chicago 19, Ill.

Cleveland District

AKRON LAMP AND MANUFACTURING CO., THE, K. G. Calaway, Factory Superintendent, 600 S. High St., Akron, Ohio.

BURRIER, RALPH W., Manager, Specification Dept., Republic Steel Corp., 1017 Republic Bldg., Cleveland 1, Ohio.

CARR, JOHN M., Senior Inspector of Engineering Materials (Aero), Office of Inspector of Naval Aircraft, U. S. Navy Dept., Bureau of Aeronautics, Akron, Ohio. For mail: 106 Broad St., Akron 5, Ohio.

WHITE, THOMAS L., Chief Engineer, The Commercial Shearing and Stamping Co., Youngstown, Ohio. For mail: 602 Willis Ave., Youngstown 7, Ohio.

Detroit District

KEWAUNEE MANUFACTURING CO., Clarence W. Greene, Technical Director, Adrian, Mich.

MATTE, JOSEPH, JR., Chief Structural Engineer, Albert Kahn Associated Architects and Engineers, Inc., 345 New Center Bldg., Detroit 2, Mich.

URQUHART, DON S., Research Engineer, The United States Graphite Co., Saginaw, Mich.

New York District

BRYANT ELECTRIC CO., THE, Roy H. Cunningham, Manager of Engineering and Sales, Hemco Plastics Div., Barnum Station, Bridgeport 2, Conn.

MAXSON CORP., THE W. L., George F. Herrmann, Metallurgist, 460 W. Thirty-fourth St., New York 1, N. Y.

UNITED MERCHANTS AND MANUFACTURERS MANAGEMENT CORP., C. L. Mantell, Technical Director, 601 W. Twenty-sixth St., New York 1, N. Y.

BOYER, J. L., Director, Technical Sales, Newport Industries, Inc., 230 Park Ave., New York 17, N. Y.

EHRMANN, ROLFE H., Research Chemist, Celanese Corporation of America, Newark, N. J. Mail: 83-06 Vietor Ave., Elmhurst, L. I., N. Y. [J]*

FEDERMAN, SAMUEL, Research Assistant, SAM Lab., Columbia University, New York, N. Y. Mail: 572 W. 141st St., New York 31, N. Y. [J]

HARDY, CHARLES, President, Hardy Metallurgical Co., 420 Lexington Ave., New York 17, N. Y.

MEDCALF, EUGENE C., Assistant Divisional Manager, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J. For mail: 459 Mountain View Terrace, Dunellen, N. J.

MEIERHANS, JOSEPH, Stylist, J. P. Stevens and Co., Inc., 1410 Broadway, New York 18, N. Y.

WARNER, A. J., Technical Director, Federal Telephone and Radio Corp., Intelin Division, 320 Orange St., Newark 5, N. J.

WILSON, J. M., Member of Technical Staff, Bell Telephone Laboratories, Inc., 463 West St., New York 14, N. Y.

Philadelphia District

SHARP & DOHME, INC., P. W. Wilcox, Director of Pharmaceutical Research, Glenolden, Pa.

GRUNDY, JAMES A., Chief, Research Dept., John Bromley and Sons, Inc., Philadelphia, Pa. For mail: 4661 G St., Philadelphia 20, Pa.

* [J]—Denotes Junior Member.

Pittsburgh District

KENNAMETAL, INC., John C. Redmond, Research Engineer and Chief Chemist, 1 Lloyd Ave., Latrobe, Pa.

BAKER, MICHAEL, JR., Owner, The Baker Engineers, Baker Bldg., 115 Shields St., Rochester, Pa.

BUCK, D. CARL, Manager, Stainless Bureau, Metallurgical Div., Pittsburgh District, Carnegie-Illinois Steel Corp., 470 Frick Building Annex, Pittsburgh 19, Pa.

HAMILTON, J. R., Assistant Plate Metallurgist and Inspector, Irvin Works, Carnegie-Illinois Steel Corp., Dravosburg, Pa.

Southern California District

BLUE DIAMOND CORP., W. G. Bradley, Vice-President, Box 2678, Terminal Annex, Los Angeles 54, Calif.

UNION DIE CASTING CO., LTD., J. M. Davis, President, 2313 E. Fifty-first St., Los Angeles 11, Calif.

Western New York-Ontaria District

ANDERSON, A. C., Engineer, Picker X-Ray Corp., 40 North St., Buffalo 2, N. Y.

CURTIS, WESLEY E., Research Fellow, New York State College of Ceramics, Alfred, N. Y. For mail: Box J-3, Alfred, N. Y. [J]

U. S. and Possessions

Other than A.S.T.M. Districts

FRIEZ INSTRUMENT DIVISION, BENDIX AVIATION CORP., Robert G. Clark, Metallurgist, Taylor Ave. at Loch Raven Blvd., Towson, Baltimore 4, Md.

PRO-PHY-LAC-TIC BRUSH CO., G. F. D'Alelio, Director of Research, Florence, Mass.

SCINTILLA MAGNETO DIVISION, BENDIX AVIATION CORP., ENGINEERING LIBRARY, Vera Morgan, Librarian, Sidney, N. Y.

SPRAGUE SPECIALTIES CO., W. W. Clark, Specifications Engineer, North Adams, Mass.

STONE & WEBSTER ENGINEERING CORP., E. LaCrosse, Engineering Manager, 49 Federal St., Boston 7, Mass.

ALLEN, HAROLD, Senior Materials Engineer, Division of Tests, Public Roads Administration, Federal Works Bldg., Washington, D. C. For mail: 9213 Midwood Rd., Silver Spring, Md.

BACON, FREDERICK S., Consulting Chemist, 192 Pleasant St., Watertown 72, Mass.

BOSTON, THE PUBLIC LIBRARY OF THE CITY OF, Boston 17, Mass.

BRITISH CENTRAL SCIENTIFIC OFFICE, J. A. V. Butler, Executive Officer, Box 680, Benjamin Franklin Station, Washington 25, D. C.

CHINA COMMISSION ON AERONAUTICAL AFFAIRS, Lynn Chu, Colonel, Chinese Air Force, 2311 Massachusetts Ave., Washington 8, D. C.

HOLMBERG, ROY EVERETT, Chief Chemist, Continental Motors Corp., Muskegon, Mich. For mail: 2146 Miner Ave., Muskegon, Mich. [J]

KOMMERS, WILLIAM J., Associate Engineer, U. S. Forest Products Laboratory, Madison, Wis. For mail: 1930 Regent St,. Madison 5, Wis.

LUMPKIN, FRANK K., Metallurgist, Cardwell Manufacturing Co., Inc., Wichita, Kans. For mail: 226 N. Charles, Wichita 12, Kans.

PITTINGER, CHARLES B., JR., Associate Chemist, U. S. War Dept., Army Air Forces, Matériel Command, Wright Field, Dayton, Ohio. For mail: Y.M.C.A., 117 W. Monument Ave., Dayton 2, Ohio.

PRINGLE, EDWARD, Chief Engineer, The J. G. Wilson Corp., Box 599, Norfolk 1, Va.

REMICK, ROSCOE HIRAM HEATH, Box 493, Dayton 1, Ohio.

UNIVERSITY OF FLORIDA LIBRARY, Nelle Barmore, Acting Librarian, Gainesville, Fla.

WAGNER, CHARLES W., Foreman and Technician, Heat Treating Dept., The Seneca Wire and Manufacturing Co., 417 Elm St., Fostoria, Ohio.

WELLY, VINCENT, Chemist, The Seneca Wire and Manufacturing Co., Fostoria, Ohio.

Other than U. S. and Its Possessions

AUSTRALIA, DIRECTORATE RADIO AND SIGNAL SUPPLIES, Ministry of Munitions, 390 Little Collins St., Melbourne, C. 1, Australia.

C. I. PAINTS, LTD., Library, Wexham Rd., Slough, Bucks., England.

Personals

• • • News items concerning the activities of our members will be welcomed for inclusion in this column.

THE NATIONAL MALLEABLE AND STEEL CASTINGS CO., Cleveland, Ohio, is celebrating its seventy-fifth anniversary, having been founded in 1868. A most interesting commemorative booklet has been issued giving the history and related information about the company, a leader in the production of malleable iron. H. W. GILBERT, Manager of Inspection and Tests, represents the Sustaining Membership of the company in the Society, and H. A. SCHWARTZ, Manager of Research, has been an active member of A.S.T.M. for over 35 years.

CHARLES F. KETTERING, Vice-President, General Motors Corp., Research Laboratories, has been awarded the John Fritz Medal by the Four Founder societies—A.S.C.E., A.S.M.E., A.I.E.E., and A.I.M.E.—"for notable achievements in the field of industrial research which have contributed greatly to the welfare of mankind and the nation." The Board of Award consists of four past-presidents of each of the societies. Previous recipients of the Medal, which is devoted to the recognition of distinguished contributions in the field of applied science, include Thomas A. Edison, George W. Goethals, Orville Wright, Guglielmo Marconi, and Herbert Hoover.

At the annual meeting of the Federation of Paint and Varnish Production Clubs held in Cleveland recently DR. J. J. MATTIELLO, Technical Director, Hilo Varnish Corp., Brooklyn, N. Y., was elected President. He has been extremely active in the protective coatings industry. Elected as a member of the executive committee of the Federation was J. C. MOORE, Superintendent, Paint Plant, Sinclair Refining Co., Marcus Hook, Pa.

C. B. BRYANT, formerly Engineer of Tests with the Southern Railway System with offices in Alexandria, Va., has recently been appointed Assistant to the Vice-President (Research and Tests). His offices are now located in Washington, D. C.

H. W. GILLETT, Chief Technical Advisor, Battelle Memorial Institute, Columbus, Ohio, will present the annual Foundation Lecture of the American Foundrymen's Association, (initiated in 1943) at the 1944 Foundry Congress to be held April 25 to 28 in Buffalo, N. Y. Doctor Gillett, an A.F.A. medalist and internationally recognized authority on metallurgy, has chosen "Cupola Raw Materials" as his subject.

EDISON JUNQUEIRA PASSOS, Public Works Commissioner, City of Rio de Janeiro Administration, Clube de Engenharia, Rio de Janeiro, Brazil, was recently made president of the Clube de Engenharia, Rio de Janeiro, to serve for three years.

JAMES H. WALKER, formerly Superintendent of Central Heating, The Detroit Edison Co., Detroit, Mich., has been appointed Assistant to the General Manager.

RAY THOMAS, Carbide and Carbon Chemicals Corp., South Charleston, W. Va., member of A.S.T.M. Committee C-16 on Thermal Insulating Materials, delivered a talk entitled "Behind the Scenes in the Development of A.S.T.M. Standards" before the Charleston Chapter of the West Virginia Society of Professional Engineers on October 15.

JAMES H. HERRON, President, The James H. Herron Co., Cleveland, Ohio, spoke at the general meeting of the Cleveland Engineering Society on Tuesday evening, October 12. His subject was "The History and Evolution of Working Tools." Mr. Herron has the largest private collection of hand tools in America many of which he displayed at the meeting.

M. REA PAUL has resigned as Chief of Specialty Rubbers Branch and from the Rubber Research Board of WPB, and has accepted appointment with the Smaller War Plants Corp. His new activity is to coordinate all aspects of the protective and technical coatings industry in such manner as to utilize the open production capacities of the small plants in filling war orders. Mr. Paul's new office is in Room 346, H.O.L.C. Building, First and Indiana Aves., N. W., Washington, D. C.

At the Twenty-fourth Annual Meeting of the American Welding Society, held October 18 in Chicago, several A.S.T.M. members were honored: DAVID ARNOTT, Chief Surveyor, American Bureau of Shipping, New York, N. Y., was elected President; and A. C. WEIGEL, Vice-President, Combustion Engineering Co., New York, N. Y., was chosen Vice-President. DAVID S. JACOBUS, Advisory Engineer (Retired), The Babcock & Wilcox Co., New York, N. Y., received the Samuel Wylie Miller Memorial Award for the most conspicuous contribution to research, standardization, and advancement of welded construction; and the Lincoln Gold Medal was awarded to GILBERT E. DOAN, Head, Department of Metallurgical Engineering, Lehigh University, Bethlehem, Pa., as one of the co-authors of the paper "Preserving Ductility in Weldments," judged the greatest contribution to the advancement and use of welding for the year.

Among the officers and directors of the Association of Consulting Chemists and Chemical Engineers elected at their annual meeting held in New York on October 26, are several A.S.T.M. members as follows: *President:* H. P. TREVITHICK, Chief Chemist, New York Produce Exchange; *Secretary:* WILLIAM C. BOWDEN, JR., Chief Chemist, Ledoux & Co., Inc.; *Directors for three years:* P. P. GRAY, Chief Chemist, Wallerstein Laboratories, and I. F. LAUCKS, President, Laucks Laboratories, Inc.

FLINT C. ELDER, Research Engineer, American Steel and Wire Company, Cleveland, Ohio, presented the 1943 Mordica Memorial Lecture at the annual meeting of the Wire Association in Chicago on Wednesday, October 20. Mr. Elder, who has been very active in A.S.T.M. work and a member for over 30 years, spoke on the subject, "The Wire Drawing Die." He developed a general formula for die pull, discussed various tests on which the formula was based, and followed with examples of practical applications. Each year the Association honors a metallurgist who is selected for his outstanding work of benefit to the industry.

BENJAMIN J. LAZAN, Chief Engineer, Sonntag Scientific Corporation, has been selected as the recipient of the Alfred Noble Prize for 1943. This prize, a substantial cash award and citation, can be made to a member of any grade of the four Founder societies and the Western Society of Engineers for a technical paper of exceptional merit, prepared by an author in the younger age brackets. Dr. Lazan's prize-winning paper entitled "Some Mechanical Properties of Plastics and Metals under Sustained Vibrations" was published in the A.S.M.E. *Transactions* of February 1943. The award is to be made at the 1943 annual meeting of the A.S.M.E. in New York City.

ARTHUR M. HOUSER, Engineer of Standards, Crane Co., Chicago, has been accorded a resolution of appreciation on retirement from the activities of the Manufacturers Standardization Society of the Valve and Fittings Industry in recognition of his long-time active service with that organization. Mr. Houser has given of his time and ability since the inception of the Society, has served as chairman and member of committees, and did much to stimulate the establishment of industrial standardization of engineering practice. Mr. Houser, who has been serving as technical advisor in the WPB Conservation Division, will continue in this capacity and also in an advisory capacity with the Crane Co., the sustaining membership of which he represents in A.S.T.M.

DOUGLAS G. WOOLF, who since 1923 as Associate Editor, and later, Editor-in-Chief of the journal *Textile World*, has represented this membership in the Society and who has been very actively interested in the work of Committee D-13 on Textile Materials, has been appointed Vice-President and Director of Information of the Textile Research Institute, Inc., New York, N. Y., which organization is greatly expanding its activities. In his new work he will direct all the information services of the Institute, and be responsible for a number of other projects in connection with the economic research committee, employer-employee relationships, and other matters, including post-war problems. During his work with *Textile World*, he won various awards for outstanding service to the industry and for his forceful writing.

GILES E. HOPKINS, very active member of the Society, particularly on Committee D-13 on Textile Materials, and former member of the A.S.T.M. Executive Committee, has resigned his position as Chief of the Industrial Products Section, Reoccupation Division, Office of Economic Warfare, to accept appointment as Research Manager of the Textile Research Institute, Inc. Mr. Hopkins has been employed in positions of technical responsi-

bility with the Bigelow-Sanford Carpet Co., United Shoe Machinery Corp., and Raybestos-Manhattan, Inc. In his new work he will have the aid of the Institute's Technical Research Committee which includes a number of A.S.T.M. members, as follows: W. D. APPEL, National Bureau of Standards; A. G. ASHCROFT, Alexander Smith and Sons Carpet Co.; F. BONNET, American Viscose Corp.; WINN CHASE, *Textile World;* C. J. HUBER, Johnson & Johnson; RINALDO A. LUKENS, Continental Mills, Inc.; and R. W. VOSE, Chicopee Manufacturing Corp.

T. JOSEPH CUERDON, JR., formerly Assistant Laboratory Foreman, Charlotte Plant, U. S. Rubber Co., Charlotte, N. C., is now Chemical Engineer, Stromberg-Carlson Radio and Telephone Manufacturing Co., 155 Wisconsin St., Rochester 9, N. Y.

HOWARD A. SMITH is now Metallurgical Engineer, Beech Aircraft Corp., Wichita, Kans. He was connected with the Tubular Alloy Steel Corp., Gary, Ind., as Chief Metallurgist.

WARREN E. EMLEY, Chief, Organic and Fibrous Materials Division, National Bureau of Standards, retired from active work on October 1 after more than 30 years of service. He was for many years at the Bureau's Pittsburgh laboratories, serving as chief of the section on lime, gypsum, and sand lime brick. In 1926 he was appointed chief of the division he headed on his retirement. The recipient of the University of Michigan's first chemical engineer's degree (graduated in 1906), he has been very active in many phases of A.S.T.M. work. He has been a member for many years and served as a member and officer of numerous committees. Detailed notations on some of his activities appear in the August, 1939, ASTM BULLETIN in an article on "Long-Time Society Committee Members." He has participated in the work of numerous societies and has written some 140 publications. The Bureau has announced that A. T. McPherson, who has been serving as head of the rubber section, will succeed Mr. Emley as division chief.

NECROLOGY

We announce with regret the death of the following six members:

J. F. NICKERSON, President, Nickerson & Collins Co., Chicago, Ill. Member since 1912.

WILLIAM C. PERKINS, Chief Engineer and Secretary, Eastern Region, National Paving Brick Assn., Langhorne, Pa. Member since 1923. At the time of his death Mr. Perkins was a member of Committee C-15 on Manufactured Masonry Units and Committee D-4 on Road and Paving Materials. He was also a member of Committee C-3 from 1924 till that committee merged with Committee C-15 in 1937, and formerly held membership on the A.S.A. Section Committee A37 on Road and Paving Materials.

GEORGE C. SQUIER, Assistant to President, J. F. Massey and Co., Inc., New York, N. Y. Member since 1936.

ENRIQUE TOUCEDA, Metallurgical Engineer, Albany, N. Y. (See accompanying note.)

J. L. VAN ORNUM, Emeritus Professor of Civil Engineering, Washington University, St. Louis, Mo. Member since 1902.

F. P. VEITCH, College Park, Md. (See accompanying note.)

Enrique Touceda

(1864–1943)

The death on October 20, 1943, of Enrique Touceda, Metallurgical Engineer and Director of Touceda Chemical and Physical Laboratories, Albany, N. Y., removes from the ranks of the Society a member of very long standing (1903) and one who has contributed much to the advancement of the Society's purpose particularly in certain ferrous metals fields. An authority on cast iron and malleable iron castings, he had been a member of Committee A-3 on Cast Iron since it was organized in 1903 and of Committee A-7 on Malleable Iron since 1918, its year of organization. For eighteen years he was secretary of Committee A-7 and also served on many of its subcommittees. Another distinctive service was his participation in the development of the Symposium on Malleable Iron Castings held jointly with the American Foundrymen's Assn. in 1931.

A graduate of Rensselaer Polytechnic Institute, he was for many years Professor of Metallurgy and later Consultant. A life member of the AFA, he was awarded the John A. Penton Medal. He was a member of a large number of other technical and scientific organizations.

F. P. Veitch (1867–1943)

In the death on October 15, 1943, of Dr. Fletcher P. Veitch, who for many years was Chief, Naval Stores Research Division, U. S. Department of Agriculture, the Society loses a long-time member (since 1908) and one who had taken a leading part in important work involving standardization and research in the field of naval stores where he was one of the country's outstanding authorities. A graduate of the University of Maryland and of George Washington University, he had been affiliated continuously with the U. S. Department of Agriculture since 1900 directing research work, in addition to naval stores, on paper, leather, tanning materials, and related products. He had retired in May, 1938, serving as collaborator until his death. In A.S.T.M., Dr. Veitch had been chairman of Committee D-17 on Naval Stores from its organization in 1924 until 1942, when he was succeeded by one of his long-time associates, V. E. Grotlisch. He had been chairman of the Subcommittee on Turpentine functioning under Committee D-1 on Paint, Varnish, Lacquer, and Related Products, for many years.

Dr. Veitch played an important role in the development of the Federal Naval Stores Act of 1923, and was in charge of its administration and enforcement. This provided legal standards of identity for turpentine and rosin. Under his leadership the first A.S.T.M. specifications and tests for turpentine were developed. His work was the basis for the present standard polymerization test for detecting and determining adulteration of turpentine. The first permanent objective standards for rosin, made from Lovibond glass, were prepared under Dr. Veitch's supervision, in 1915. The Naval Stores Act in 1923 included these standard types (which are prepared in the Department of Agriculture) as the mandatory color standards for grading all rosin.

In addition to active service on Committees D-17 and D-1, he had been a member of Committees E-6 on Papers and Publications and C-7 on Lime.

In these notes the Society records its appreciation for his important Society work throughout the years in developing and carrying through to fruition important technical projects so important to the industry in which he was a leader. His associates in A.S.T.M. work will keenly regret his passing.

Radiographic Testing

Two BOOKS have been received dealing with the industrial applications of radiography. One by Messrs. Ancel St. John and Herbert R. Isenburger entitled "Industrial Radiology—X-Rays and Gamma Rays," is the second edition, which includes as an important feature a most extensive bibliography of over 1300 references. The authors' intent has been to cover the practical aspects of radiology in a way that the layman can follow. The title, of course, is intended to include radiography and fluoroscopy. The 300-page book can be obtained from John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y., at $4 per copy.

The other publication in small page-size covers "Radiographic Inspection of Metals," by Dr. Otto Zmeskal, issued by Harper & Brothers, 49 E. 33rd St., New York 16, N. Y. This is an introductory textbook on the principles and practice of radiography as applied in the inspection of metals, based on the author's lectures at the Illinois Institute of Technology. There are many line drawings and other illustrations intended to aid in presenting the subject clearly. There is a glossary of terms, list of selected references, and other data. Copy of the 160-page book can be purchased for $2.75.

EDITOR'S NOTE.—Reference has been made to some of these Emergency Alternate Provisions in news articles appearing in the October BULLETIN; see also article on standards actions, this issue.

EA – A 30, EA – A 201, EA – A 202, EA – A 203, EA – A 204, EA – A 212

Issued, November 17, 1943

The following Emergency Alternate Provision, when specified, may be used as an alternate in the following specifications and affect only the requirements referred to:

Boiler and Firebox Steel for Locomotives (A 30 – 42).

Carbon-Silicon Steel Plates of Ordinary Tensile Ranges for Fusion-Welded Boilers and Other Pressure Vessels (A 201 – 43).

Chrome-Manganese-Silicon (CMS) Alloy-Steel Plates for Boilers and Other Pressure Vessels (A 202 – 39).

Low-Carbon Nickel-Steel Plates for Boilers and Other Pressure Vessels (A 203 – 42).

Molybdenum-Steel Plates for Boilers and Other Pressure Vessels (A 204 – 42).

High Tensile Strength Carbon-Silicon Steel Plates for Boilers and Other Pressure Vessels (Plates $4^1/_2$ in. and Under in Thickness) (A 212 – 39).

In each of the above specifications provide for limited marking on small plates by an emergency marking clause to read as follows:

Plates whose maximum lengthwise and crosswise dimensions do not exceed 48 in. shall have the marking* stamped in one place approximately midway between the center and an edge. (* EDITOR'S NOTE: Marking symbols are covered in the regular marking clause.)

EA – A 70

(Standard Specifications for Carbon-Steel Plates for Stationary Boilers and Other Pressure Vessels (A 70 – 42)

Issued, November 17, 1943

Section 4.—Change the sulfur content for firebox grade from the present "0.04 per cent" to read "0.045 max., per cent."

Section 7.—Change the tensile strength, psi., for both flange and firebox grades from the present "55,000 to 65,000" to read "55,000 to 70,000."

Also, provide for limited marking on small plates by an emergency marking clause to read as follows:

Plates whose maximum lengthwise and crosswise dimensions do not exceed 48 in. shall have the marking* stamped in one place approximately midway between the center and an edge. (* EDITOR'S NOTE.—Marking symbols are covered in the regular marking clause.)

EA – A 89

(Standard Specifications for Low Tensile Strength Carbon-Steel Plates of Flange and Firebox Qualities (A 89 – 43)

Issued, August 30, 1943

Table I.—Change the sulfur content for firebox grade from the present "0.04 per cent" to read "0.045 max., per cent."

EA – A 167a

(Standard Specifications for Corrosion-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip (A 167 – 43)

Issued, August 30, 1943

(Superseding Issue of May 7, 1942)

This Provision modifies a previous one by omitting the nickel requirements for Grades 5 and 6 (Type Numbers 321 and 347, respectively) in Table I, Chemical Composition, and also deleting Grade 12 (Type Number 317) from the table.

EA – A 214a

Issued, August 30, 1943

(Superseding Issue of August 18, 1942)

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Electric-Resistance-Welded Steel Heat-Exchanger and Condenser Tubes (A 214 – 42) and affect only the requirements referred to:

Section 3.—Change to read as follows by the addition of the note:

3. Tubes shall be made by electric-resistance welding and shall be normalized at a temperature above the upper critical temperature (Note).

NOTE.—Normalizing may be waived upon agreement between the manufacturer and the purchaser.

Section 6.—Change Paragraphs (*a*) and (*b*) to read as follows by the addition of the note:

6. (*a*) For tubes having wall thicknesses not exceeding 10 per cent of their outside diameters, a section not less than $2^1/_2$ in. in length shall stand being flattened between parallel plates until the distance between the plates is three times the wall thickness (Note), without cracking or showing flaws.

(*b*) For tubes having wall thicknesses exceeding 10 per cent of their outside diameters, a section not less than $2^1/_2$ in. in length shall stand being flattened between parallel plates until the distance between the plates is four times the wall thickness (Note), without cracking or showing flaws.

NOTE.—If unnormalized tubes are ordered, the flattening test requirements shall be five times the wall thickness.

Section 8.—Change Paragraph (*b*) to read as follows by the addition of the note:

(*b*) The tubes shall have a Rockwell hardness number not to exceed B72 (Note).

NOTE.—If unnormalized tubes are ordered, the maximum Rockwell hardness shall be B80.

Section 9.—Change the title of this section to read "Hydrostatic Test or Electric Test" and change to read as follows:

9. (*a*) *Hydrostatic Test.*—Each tube shall be tested at the mill and shall withstand a minimum hydrostatic pressure of 1000 psi., for a minimum period of 10 sec. at the full pressure.

NOTE.—When requested by the purchaser and so stated in the order, tubes shall be tested to one and one-half times the specified working pressure (when one and one-half times the specified working pressure exceeds 1000 psi.) provided the fiber stress corresponding to those test pressures does not exceed 16,000 psi., as determined by the following formula:

$$S = \frac{PD}{2t}$$

where:

S = fiber stress,
P = hydrostatic test pressure in pounds per square inch,
D = outside diameter of the tube in inches, and
t = thickness of the tube wall in inches.

(*b*) *Electric Test.*—In lieu of the hydrostatic test, when mutually agreed upon by the purchaser and manufacturer, each tube shall be tested at the mill by passing through a nondestructive electric tester which is capable of detecting defects $^1/_{16}$ in. in length and one-half the wall thickness or defects of any length completely penetrating the wall. Such tests shall be made on the welded seam and the adjacent metal affected thereby.

EA – A 240a

(Standard Specifications for Corrosion-Resisting Chromium and Chromium-Nickel Steel Plate, Sheet, and Strip, for Fusion-Welded Unfired Pressure Vessels (A 240 – 43)

Issued, August 30, 1943

(Superseding Issue of May 7, 1942)

This Provision modifies a previous one by having the change in carbon content (from 0.07 to 0.08) apply only to Grade S instead of both Grades S and M, in Table I.

EA–D 147

Issued, August 30, 1943

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Methods of Testing Bituminous Mastics, Grouts, and Like Mixtures (D 147 – 41) and affect only the requirements referred to:

Section 3 (a).—To provide for the use of an alternative extraction apparatus made of tinned copper and having a glass condenser as shown in the accompanying Fig. 1a, change this section to read as follows by the addition of the italicized words and figures:

3. (*a*) For Analysis of 10 to 30-g. Samples.—In cases where a 10 to 30-g. sample is sufficient, the analysis shall be carried out by means of the glass extractor, shown in Fig. 1 *or the accompanying Fig. 1a.*

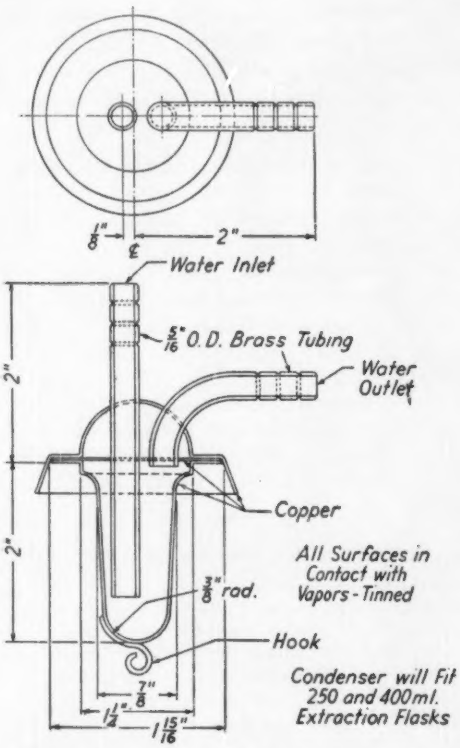


Fig. 1a.—Extraction Apparatus for Analysis of 10 to 30-g. Samples.

EA – D 224a

(Tentative Specifications for Asphalt Roofing Surfaced with Powdered Talc or Mica (D 224 – 41 T)

Issued, August 30, 1943

(Superseding Issue of May 11, 1942)

Table I on Physical Requirements of Asphalt Roofing.—Change the weight of dry felt per 108 sq. ft. (65-lb. grade) from "13.5" to read "13.05" lb., minimum.

For the 65-lb. grade, change the weight of saturant (soluble in CS_2) per 108 sq. ft. from "21.6" to read "20.9" lb. minimum.

EA – D 228

Issued, August 30, 1943

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Tentative Methods of Testing Asphalt Roll Roofing, Cap Sheets, and Shingles (D 228 – 42 T) and affect only the requirements referred to:

Section 9.—Change the first paragraph of this section to read as follows by the addition of the italicized words and figures and the omission of the words in brackets:

From the rolls examined, the one whose weight per 108 sq. ft. is nearest the average weight of the lot shall be selected. The roll so selected shall be laid flat, the first convolution or two carefully unwound and with a knife and straight edge the sheet shall be cleanly cut across at right angles to the edges. A sample measuring [exactly] 30 in. *plus or minus* $^1/_{32}$ *in.* in the direction of the roll's length shall be removed. *Any unsurfaced lapping edge of the roll shall be removed and* the width of [this sample] *the surfaced area* shall be measured to the nearest $^1/_{32}$ in. The weight of the sample in ounces shall be determined, neglecting any loose surfacing. The weight in pounds per 108 sq. ft. shall be calculated as follows:

$$\text{Weight, lb. per 108 sq. ft.} = \frac{A}{B} \times 32.4$$

where:

A = weight of 30-in. sample in ounces,
B = width of 30-in. sample in inches, and
32.4 = *factor for converting ounces per measured unit area (30 in.* $\times$ *B) to pounds per 108 sq. ft.*

EA – D 249a

(Tentative Specifications for Asphalt Roofing Surfaced with Coarse Mineral Granules (D 249 – 42 T))

Issued, August 30, 1943

(Superseding Issue of May 11, 1942)

In Sections 6 (b), 10 (a), 12 (a) (selvage), change the present 3-in. bare lapping edge to 4 in., with corresponding changes in Table I, (area), and Section 10 (a) of 114 sq. ft. instead of the present figure, 111. In Table I the weight per roll with a 4-in. bare edge will be 83 lb. Also in Section 12 (a) omit the requirements for protective coating on the nails.

EA – D 496a, EA – D498a

(Issued, August 30, 1943)

(Superseding Issue of May 15, 1942)

The following Emergency Alternate Provisions, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Chip Soap (D 496 – 39) and in the Standard Specifications for Powdered Soap (Non-alkaline Soap Powder) (D 498 – 39) and affect only the requirements referred to:

Section 3.—In the table of chemical composition requirements, add the following requirement for rosin acids:

Rosin acids, max., per cent based on finished product.............10

Change the titer test requirement to read as follows by the addition of the italicized figures and the omission of those in brackets:

Titer of the mixed fatty acids prepared from the soap min...[39] *36* C.

Coordinating Dimensions of Building Materials

After several years' work, a sectional committee functioning under A.S.A. procedure and sponsored by the American Institute of Architects and the Producers' Council, Inc., has issued for information and comment a proposed American Standard Basis for the Coordination of Dimensions of Building Materials and Equipment. This work carries the symbol A62.1. Copies of the document and additional information, if desired,

will be supplied by M. W. Adams, secretary of the committee, who can be addressed at the Modular Service Association, 110 Arlington St., Boston 16, Mass. With the proposed standard basis is a list of the committee personnel which includes Theodore Irving Coe as the A.S. T.M. representative. There is discussion of the objectives and advantages of this dimensional coordinating work, which if widely applied, would have tremendous benefits.

Cargo Vessels Named After Members

THERE HAS BEEN considerable publicity, both technical and news items, in connection with the building of reinforced concrete cargo vessels, but aside from this members will be interested in a selection of names for various vessels being built by McCloskey & Co., at Tampa, Fla. A number of boats launched and in process have been named after men, some, active members of A.S.T.M., who were authorities in the field of cement, concrete, and related materials. A list follows:

Ship No. 1—Vitruvius
Ship No. 2—David O. Saylor
Ship No. 3—Arthur Newell Talbot
Ship No. 4—Richard Lewis Humphrey
Ship No. 5—Richard Kidder Meade
Ship No. 6—Willis A. Slater
Ship No. 7—Leonard Chase Wason
Ship No. 8—John Smeaton
Ship No. 9—Joseph Aspdin
Ship No. 10—John Grant
Ship No. 11—M. H. LeChatelier
Ship No. 12—L. V. Vicat
Ship No. 13—Robert Whitman Lesley
Ship No. 14—Edwin Thacher
Ship No. 15—C. W. Pasley

Many of these vessels have already been launched.

New Book on Patent Law

THIS VOLUME, BY Chester H. Biesterfeld, a practicing patent lawyer with a chemical engineering degree, is designed for chemists, engineers, and students, and affords a treatment of each of the principal subjects supported by citations and quoted material from various court decisions. The book is an outgrowth of lectures given at the University of Delaware in the past two years. Because of the interest aroused it was suggested the author compile and edit his lectures for publication. The book may be of interest to many materials and testing engineers who do not have a professional training in law, but who are concerned occasionally with an understanding of some proposition of patent law. The book is carefully sectionalized; there is a complete table of cases cited; a condensed bibliography and a subject index. Copies can be obtained from the publishers, John Wiley & Sons, Inc., 440 Fourth Ave., New York, 16 N. Y., at $2.75 each.

A.S.T.M. Emergency Standards and Alternate Provisions

BECAUSE THERE has recently been published in separate pamphlet form a complete list of emergency standards and emergency alternate provisions, the list which has been included in each issue of the BULLETIN is not published in this December number, but there follow the titles of emergency alternate provisions which have become effective since October. These items, together with those published in the October BULLETIN, provide a complete and up-to-date list of the emergency specifications and alternate provisions.

EA - A 30 Boiler and Firebox Steel for Locomotives (A 30 - 42).
EA - A 201 Carbon-Silicon Steel Plates of Ordinary Tensile Ranges for Fusion-Welded Boilers and Other Pressure Vessels (A 201 - 43).
EA - A 202 Chrome-Manganese-Silicon (CMS) Alloy-Steel Plates for Boilers and Other Pressure Vessels (A 202 - 39).
EA - A 203 Low-Carbon Nickel-Steel Plates for Boilers and Other Pressure Vessels (A 203 - 42).
EA - A 204 Molybdenum-Steel Plates for Boilers and Other Pressure Vessels (A 204 - 42).
EA - A 212 High Tensile Strength Carbon-Silicon Steel Plates for Boilers and Other Pressure Vessels (Plates $4^1/_2$ in. and Under in Thickness) (A 212 - 39).

Hail to the Concrete Inspector!

Who takes all the raps and the buffets and blame
When the work and the "specs" are not quite the same?
Who carries the load of the public protector?
It's the wirey hard-bitten old concrete inspector!

The work must be perfect from digging to dome
And each operation recorded in tome.
Materials, workmanship must be correct or
Woe unto him—the concrete inspector!

Up early at morning, with flashlight at night,
He tests and he pests and he keeps up the fight.
He interprets the thoughts of the brass-hat director,
He checks and he rejects—the concrete inspector!

Oh give me a man who has patience and tact,
With a keen sense of sight and a bone in his back,
Who can get the job done and of none is respecter,
And I'll make him immortal—that concrete inspector!

—J. W. Kelley in September, 1943, *Civil Engineering*

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